SUMMARY OF TRANSPORTATION INFORMATION FOR THE UPTOWN AREA

DRAFT

March 1987

DRAFT

Summary of Transportation Information for the Uptown Area

prepared by

Cambridge Systematics, Inc.
222 Third Street
Cambridge, Massachusetts 02142

March 5, 1987

CONTENTS

CONTENTS - Continued

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

Traffic congestion and parking availability have been longstanding concerns in the Uptown Area which is defined here as the Back Bay and portions of the South End and Fenway areas (see Figure 1.1). Several recent development proposals have been met with questions about the ability of the area's streets and parking facilities to absorb additional growth. These questions have been addressed largely on a fragmented, development by development basis through Environmental Impact Studies conducted for individual projects.

This approach has not produced the kind of unified transportation strategy and coordinated action which is critical to address existing problems and better accommodate future growth.

This report provides a starting point for development of such a strategy. It synthesizes information from individual development plans and a variety of other studies in order to provide an overview of present transportation problems and their causes, the likely impacts of planned future developments and other changes, and the kinds of strategies which have been proposed to improve transportation.

Study Area Today

The Study Area is a diverse area, containing a neighborhood with 16,000 residents, Boston's two largest skyscrapers which form the core of one of the city's major concentrations of employment - particularly for the insurance industry, a variety of specialty shops and department stores, nearly 6,000 hotel rooms, and a number of cultural and educational institutions.

This diversity is an important strength--it is what makes the Area a convenient and enjoyable place to live, shop, and work. However, diversity is the source of many of the Area's most difficult transportation problems -- maintaining access for employees while keeping traffic on residential streets down to tolerable levels, providing adequate parking for residents, shoppers, visitors, delivery vehicles, and employees, and maintaining safe and convenient circulation within the Study Area for pedestrians, cars, and buses. Managing the competing users of the transportation system is and will continue to be the most important challenge for the Area.

Access to the Study Area by car is relatively convenient due to the good connections from the Mass Turnpike and Storrow Drive, and the grid system of local streets which, unlike the cowpaths of downtown Boston, provide traffic with many alternate routes between different parts of the area. Public transportation access to the Study Area is quite good--including four Green Line stations and a number of express and local bus routes. However, the combination of easier automobile access and parking availablity and somewhat less convenient public transit access to the Study Area, relative to downtown Boston, is reflected in how employees in the two areas travel to work--38-40 percent of Study Area employees come by car, versus only 25-30 percent of downtown employees.

Both drivers and public transit riders to the Study Area face significant rush hour congestion. On the Green Line, which carries the vast majority of public transit riders to the Area, crowded conditions persist on rush hour trains, and passengers must cope with service which is often unreliable and difficult to understand. Drivers can expect to face traffic backups at points of entry from Storrow Drive, Massachusetts Avenue,

and the Southeast Expressway. Access to Storrow Drive eastbound (and the Central Artery) has become considerably more difficult since the reversal of Charles St. in 1982, which caused large volumes of traffic to shift to Berkely Street.

Parking is perceived as a major problem in the Study Area. Despite the fact that off-street parking facillities presently have a midday surplus of nearly 2000 spaces, competition is fierce for the more convenient, less expensive on-street spaces. The on-street parking shortage results in double parked cars and delivery vehicles, and cruising vehicles in search of spaces, which are major contributors to the Area's traffic problems. Institution of resident permit parking has made the situation somewhat easier for residents, but it has made parking more difficult for shoppers and visitors--who are more vulnerable to a parking shortage than commuters.

While circulation within the Study Area is facilitated by the grid system, there are certain locations where the combination of high pedestrian volumes and traffic create conflicts, making it difficult and unsafe for pedestrians to cross the street, and delaying drivers who must wait for jaywalkers to cross.

The Study Area's parking and internal circulation problems can be addressed through better management of the system. Some management strategies, such as resident permit parking, peak hour parking restrictions to smooth traffic flow, and a merchant shopper parking discount progam for the Prudential garage have already been implemented, but much more can be done.

Access problems present a more difficult challenge, given the need to protect residential areas from heavy traffic. Addressing these problems will require a series of coordinated and deliberate steps to adjust traffic circulation patterns, develop new access opportunities and improve public transit. Many such steps will be taken in the near future, but further action is needed, and should be planned for with consideration of future development and planned transportation system changes.

Study Area Tomorrow

In the past three years, development of Copley Place, the State Transportation Building, and six other smaller projects added 2.6 million square feet of office and retail space, and about 2,000 hotel rooms to the Study Area. New developments which will open in the 1986 to 1990 period will add another 1.9 million square feet, and 500 residential units. Major developments to be completed by 1990 include the 500 Boylston New England Life project, expansion of the Hynes Auditorium, and the Heritage-on-the-Garden (Arlington/Hadassah) project.

Developments in the 1986-1990 period are projected to add roughly 3000 more vehicles in the evening rush hour period and generate the demand for over 2000 more parking spaces than they will supply. They are also projected to add nearly 5000 new peak period transit passengers.

These projections assume no major changes in transportation access (other than the Orange Line and the Park Square Improvement Project), and assume that people will continue to travel to the Area in much the same way as they do today. In fact, past trends show that there is by no means

a straightforward relationship between development and transportation conditions.

Changes in demographics, the distribution of population growth, the level of public transit service and ridesharing, and the location and magnitute of highway congestion are all important factors which determine how the impacts of new development will be felt.

For example, between 1972 and 1982, the Study Area was able to absorb 2.5 million square feet of office space, including the Hancock Tower without a significant deterioration in traffic conditions, despite the fact that rapid transit usage dropped significantly during this period. The explanation for this lies in a combination of factors: the availability of capacity on the Mass Pike and Storrow Drive and within the Area's grid of streets, the direct connection between the Hancock Garage and the Turnpike, the availability of several alternative routes to the Southeast Expressway and Storrow Drive which allows traffic to disperse rather than concentrate, and changing demographics.

However, recent studies have noted a marked increase in Study Area traffic in the past 2-3 years. These traffic increases are clearly a result of the reversal of Charles St. in 1982 which shifted traffic into the Area, worsening congestion on regional highway facilities which has resulted in an increase in traffic travelling through the Study Area and the unprecedented amount of development between 1983-1985.

In the future, the Study Area's congestion problems will get worse unless an action plan is developed to better manage traffic both through and to the area and encourage other modes of access. A critical part of

meeting this challenge will be improvements to public transportation services which have tremendous untapped potential. In addition, a host of other steps can be taken to take full advantage of the inherent access and circulation capabilities of the street system.

Strategies for the Future

There is no shortage of ideas for improving transportation conditions in the Study Area. A review of recent studies found proposals for no less than 67 different actions to improve access, smooth traffic flow, reduce traffic on residential streets, address parking problems, improve pedestrian circulation, and manage future traffic growth. There is general agreement on doing a number of simple, relatively low cost things, such as putting up guide signs to alternate routes to Storrow Drive and the Southeast Expressway, improving operations at a number of problem intersections, increasing the enforcement of existing parking regulations, and strengthening employer-based programs to encourage carpooling and transit use. There is also support for computerizing the traffic signal system and making further improvements to the public transportation system.

Strategies which would have major impacts on traffic access and circulation -- such as reversal of Charles Street, making Boylston Street two-way, and constructing new eastbound access points to the Mass Pike and Storrow Drive are more controversial. This controversy exists because the impacts of such actions are complex and require careful study, and more importantly because there are fundamental differences in philosophy about how existing and future traffic problems should be addressed. Some people

believe that traffic should be discouraged rather than accommodated, and that improving traffic flow will just bring more traffic. A number of proposals have been advanced to restrict access to the Study Area, institute discontinuous flow patterns on some of the residential streets, and limit future development.

Past studies have provided a laundry list of improvements which offer a variety of bandaid solutions to transportation problems in the Study Area. Because there has been no coordinated, Area-wide appproach to transportation planning, it has been impossible to develop a consensus on a set of actions to address the diverse set of problems which exist, which would on balance be acceptable to the diverse groups with a stake in the Area.

Next Steps

It is time to develop a transportation strategy which considers the cumulative impacts of planned developments, as well as the likely influence of future changes in transportation conditions external to the Study Area. Such a strategy must be shaped by the organizations and individuals who are affected by the Area's transportation problems, and who have the resources and ability to achieve results.

Important next steps toward addressing existing and future transportation problems are:

1. Establish awareness that a comprehensive approach is needed and gain the participation of public and private sector organizations and community groups,

2. Develop a credible, up-to-date base of information on existing conditions and problems, and the implications of future development and transportation system changes,

3. Develop a coordinated agenda of future transportation improvements which has widespread support, and

4. Gain commitments to implement these improvements.

1.0 THE TRANSPORTATION SYSTEM

The Study Area for this report is the same as the area included in the 1985 Back Bay Transportation Study conducted for the City of Boston[1] and is shown in Figure 1.1.

Street Network

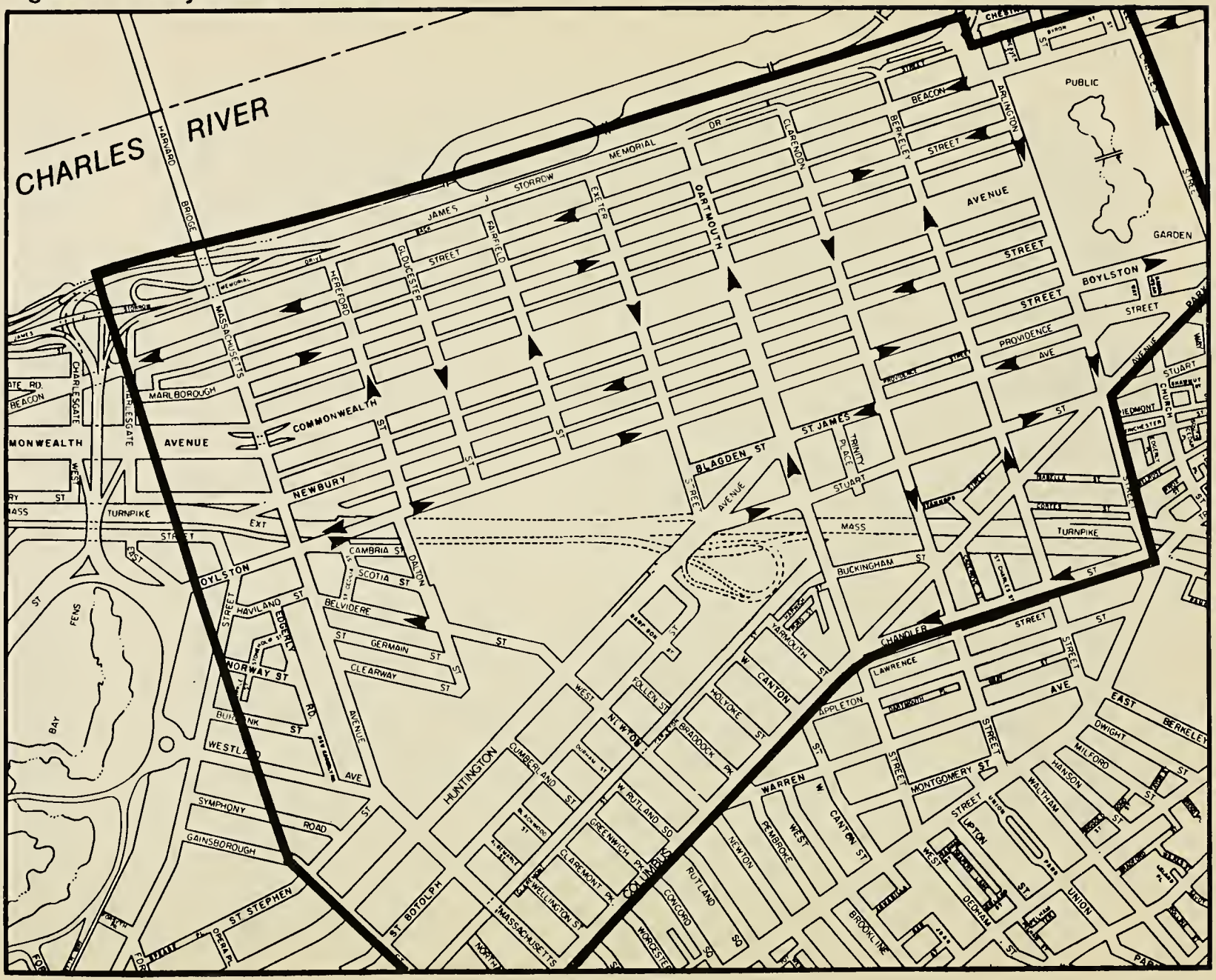
Unlike the cowpaths of downtown Boston, the Study Area's street network is composed primarily of an orderly grid of north-south and east-west streets. Between Huntington Avenue and Columbus Avenue, a secondary grid system runs at roughly a 45 degree angle to the primary grid. The grid system of streets provides a significant advantage over downtown Boston in terms of local circulation, both because it is easily understandable by motorists, and provides traffic with many alternate routes between different parts of the area.

Both the north-south and east-west streets in the primary Back Bay grid are one-way, alternating in direction of flow. Two street segments are exceptions to this rule--Boylston Street between Hereford and Mass. Avenue is two way to allow access to Mass. Avenue and points west from Dalton Street, and the section of Marlborough Street between Arlington and Berkeley is reversed in direction from the rest of Marlborough (eastbound instead of westbound) in order to decrease through traffic on Marlborough Street, which is entirely residential.

---

[1]HMM Associates, "Back Bay Neighborhood Transportation and Traffic Engineering Study: Final Report" prepared for Boston Traffic and Parking Department, August 1985.

Figure 1.1 Study Area Circulation

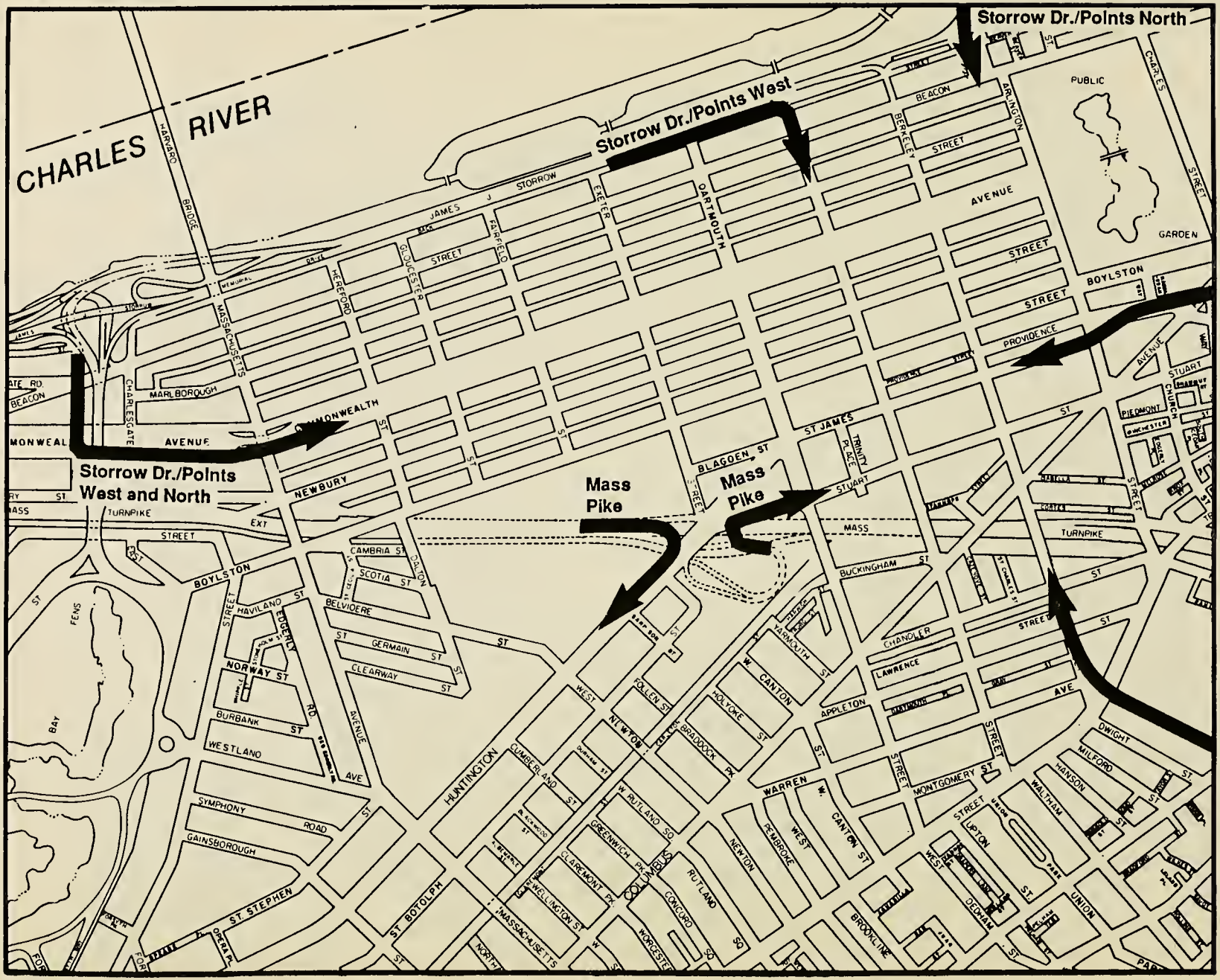


Major Access Routes

Major routes to and from the Study Area are illustrated in Figures 1.2 and 1.3. Storrow Drive and the Mass Turnpike are the major access routes from points to the north and west. Mass Turnpike on ramps are located at Newbury Street/Mass. Avenue, the Dartmouth/Huntington/St. James intersection, and at the Hancock Garage on Clarendon Street between Stuart Street and Columbus Avenue. Mass Pike off ramps are on Huntington Avenue (near Ring Road) and Stuart Street (near Huntington Avenue). Access to Storrow Drive westbound is provided at Berkeley Street and Charlesgate (via Beacon Street or Commonwealth Avenue). Storrow Drive eastbound (connecting to Route 93 north and the Central Artery) may be reached via the Berkeley Street on ramp or at Beacon Street/Arlington Street via Embankment Road. In late 1982, the direction of Charles Street between Beacon Street and Cambridge Street was reversed from northbound to southbound, which removed a major route to the Central Artery from the Study Area. Some traffic now reaches the Central Artery by travelling around the Public Gardens to Beacon Street, or by cutting across Beacon Hill in order to avoid congestion on Storrow Drive at Leverett and Charles Circles.

The Southeast Expressway is the major access route from the south. From the Southeast Expressway, traffic can reach the Study Area via East Berkeley and Berkeley Streets, Kneeland/Stuart Streets or from the Mass. Avenue/Southampton Street exit. Outbound traffic from the Study Area reaches the Southeast Expressway via Arlington Street and Herald Street or via Mass. Avenue.

Figure 1.2 Major Access Routes



Parking

The Study Area contains a total of 10,976 off street parking spaces,[1] or 20 percent of the parking in Central Boston. One half of these parking spaces (5,460 spaces) are available for general public use. The remaining 5,516 spaces are reserved for private use (e.g., residents, employees, hotel guests). Three garages provide 55 percent of the parking supply--the Prudential garage, with 2,980 spaces, the Hancock Garage, with 1,784 spaces, and the Copley Place garage(s), with 1,442 spaces. Major parking facilities (with over 100 spaces) are shown in Figure 1.4. Table 1.1 provides a complete parking inventory.

The inventory information in Table 1.1 was based on a 1983 City of Boston parking study,[2] updated to incorporate changes resulting from new development between 1983 and today, and existing construction activity. Figure 1.5 shows the zone system used in the City of Boston parking study. The inventory information should be fairly accurate. A summary of the existing breakdown of spaces in the Prudential Center garage is included in Appendix C.

Public Transportation

The existing public transportation system serving the Study Area is shown in Figure 1.6 include:

---

[1]Excluding the 625 space St. James Garage, which is presently under construction as part of the 500 Boylston project.

[2]Cambridge Systematics, Inc., "Parking in Central Boston: Meeting the Access Needs of a Growing Downtown", prepared for Boston Traffic and Parking Department, December 1983.

Figure 1.3 Major Egress Routes

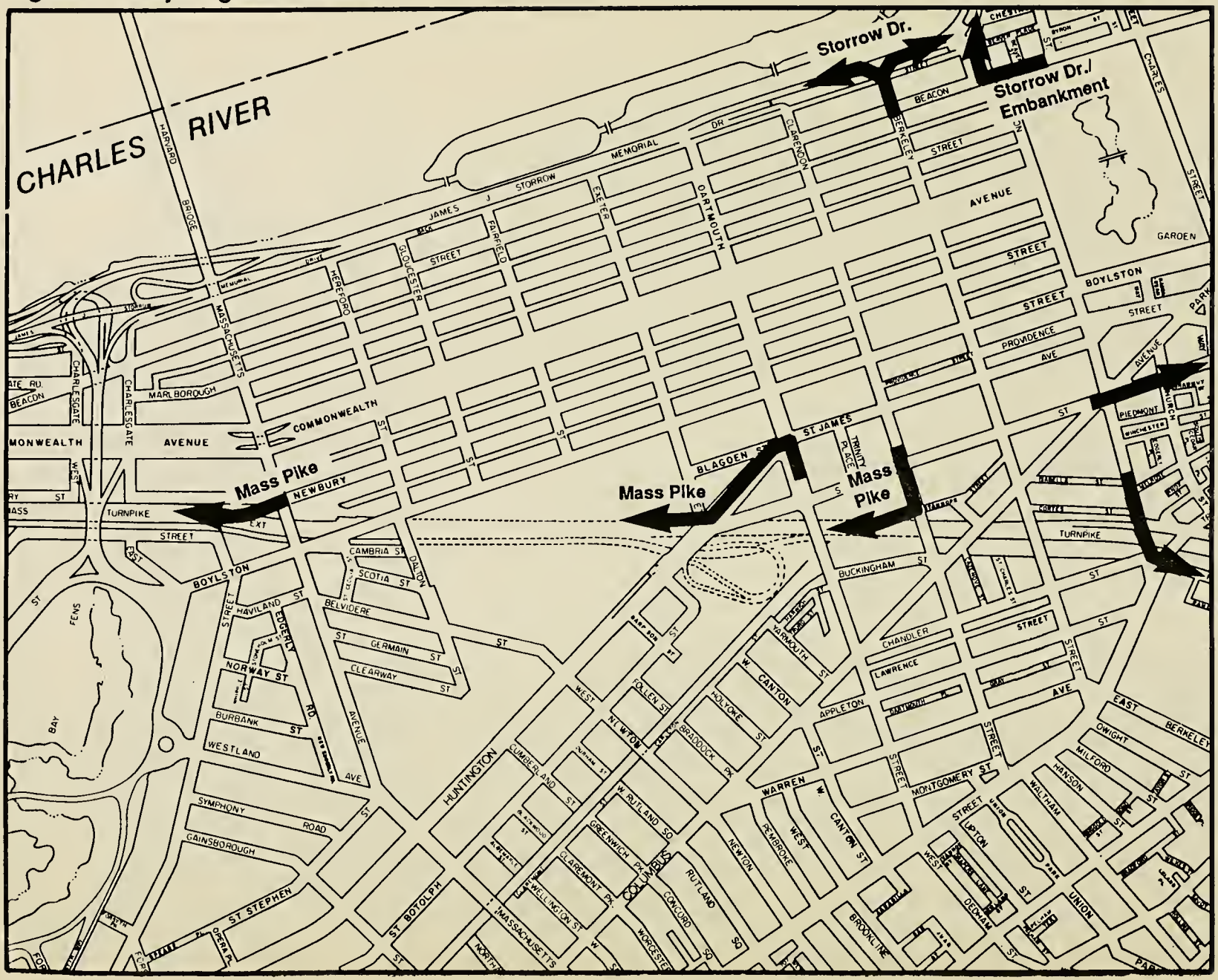
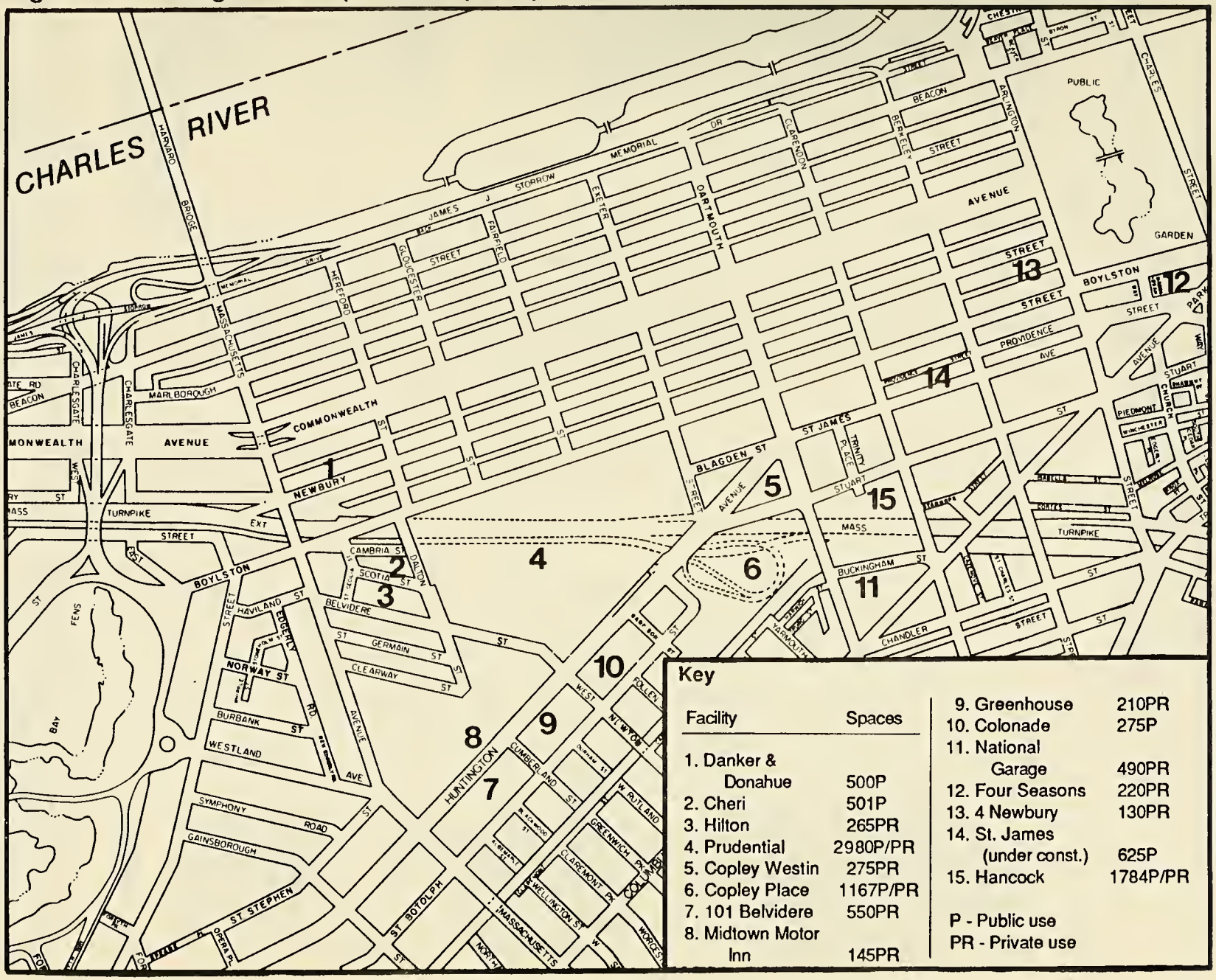


Figure 1.4 Parking Facilities (over 100 spaces)



Key

Facility	Spaces
1. Danker & Donahue	500P
2. Cheri	501P
3. Hilton	265PR
4. Prudential	2980P/PR
5. Copley Westin	275PR
6. Copley Place	1167P/PR
7. 101 Belvidere	550PR
8. Midtown Motor Inn	145PR
9. Greenhouse	210PR
10. Colonade	275P
11. National Garage	490PR
12. Four Seasons	220PR
13. 4 Newbury	130PR
14. St. James (under const.)	625P
15. Hancock	1784P/PR

P - Public use
PR - Private use

TABLE 1.1 Parking Inventory (Continued)

FACILITY (BY BRA #)	PUBLIC LOT	PRIV LOT	PUBLIC GARAGE	PRIV GARAGE	TOTAL SPACES AVAIL	PEAK ACCUM (noon)	PERCENT CAPA-CITY**	RATES ONE HOUR	RATES EIGHT HOUR	NOTES
Zone 7-B										
27 BLAGDEN	60				60	65		$2	$6	
200 NEWBURY	50				50	60		$4	$10	
248 278-84 DARTMOUT	71				71	40		$4	$12	
249 ALLEY 434		14			14	11				
253 SUNOCO STATION	25				25	22		NA	NA	
255 DANKER & DONAHUE			500		500	199		$4	$6	
259 939 BOYLSTON		22			22	18				
260 CHERI			501		501	506		$2	$5	
261 BACK BAY HILTON				265	265	*				
262 PRUDENTIAL		87	1902	991	2980	2218		$2	$7	PRU SURVEY 12/84; PEAK ACCUM
276 COPLEY (WESTIN)				275	275	*				FOR GARAGES ONLY
276 COPLEY (MARRIOT)				307	307	*				
Subtotal	206	123	2903	1838	5070	3139	75.9%			
Zone 9-A										
263 101 BELVIDERE				550		447				
264 MIDTOWN MOTOR INN				145		75				
265 156-186 HUNTINGTON				210		*				
266 COLONADE			275			106		$2	$6	
267 FOLLEN STREET				20		22				
268 GARRISON STREET				28		43				
269 GARRISON HALL		18				29				
276 COPLEY PLACE			860			*				
Subtotal	0	18	1135	953	2106	722	69.7%			
Zone 9-B										
270 BRADDOCK PARK		38				21				
272 YARMOUTH/TRURO	47					59		NA	NA	
272 104 DARTMOUTH	23					20		NA	NA	
272 25 YARMOUTH	61					59		$2	$5	
272 130 DARTMOUTH	68					50		$2	$5	
273 COLUMBUS AVE		28				19				
278 NATIONAL GARAGE				490		450				FUTURE EXPANSION BY 300 SPACES FOR 500 BOYLSTON
280 75 CLARENDON	(70)					*				UNDER CONSTRUCTION
Subtotal	199	66	0	490	755	678	89.8%			

*ACCUMULATION COUNT NEEDED
**INCL ONLY FACILITIES W/ACCUM CNTS

TABLE 1.1 Parking Inventory

FACILITY (BY BRA #)	PUBLIC LOT	PRIV LOT	PUBLIC GARAGE	PRIV GARAGE	TOTAL SPACES AVAIL	PEAK ACCUM (noon)	PERCENT CAPA-CITY**	RATES ONE HOUR	RATES EIGHT HOUR	NOTES
Zone 7-A										
168 FOUR SEASONS				220		*				
181 66 CHURCH ST	62					59				
183 107 ARLINGTON		84				106				
184 CORTEZ		17				14				
185 174 COLUMBUS		22				20				
186 40 ISABELLA		30				22				
187 187 COLUMBUS		35				27				
188 107 ARLINGTON	52					60		$3	$6	
189 ALLEY 559		10				13				
190 380 STUART		16				11				
191 STUART		30				25				
192 STANHOPE GARAGE	52					54		$2	$6	
193 400 STUART	77					105		$3	$8	
224 80 NEWBURY				80		*				ACCESS DENIED
234 ALLEY 438		11				5				
235 4 NEWBURY				130		91				
236 RITZ CONDOS				50		12				
239 60 NEWBURY		41				56				
240 ST. JAMES/STUART		60				42				
241 ST. JAMES GARAGE			(625)			(519)		$2	$6	UNDER CONSTRUCTION
242 HANCOCK GARAGE			774	1010		1605				
Subtotal	243	356	774	1490	2863	2327	90.8%			
Zone 6-B										
237 299 BERKELEY		17				15				
238 60 MARLBOROUGH		12				11				
Subtotal	0	29	0	0	29	26	89.7%			
Zone 8										
246 330 COMMONWEALTH				20		6				
250 236 BEACON APTS		18				7				
251 256 BEACON ST		11				23				
252 330 BEACON ST				72		42				
254 424 BEACON ST		32				31				
Subtotal	0	61	0	92	153	109	71.2%			
TOTAL	648	653	4812	4863	10976	7001	80.7%			

*ACCUMULATION COUNT NEEDED
**INCL ONLY FACILITIES W/ACCUM CNTS

Figure 1.5 Parking Inventory Zones

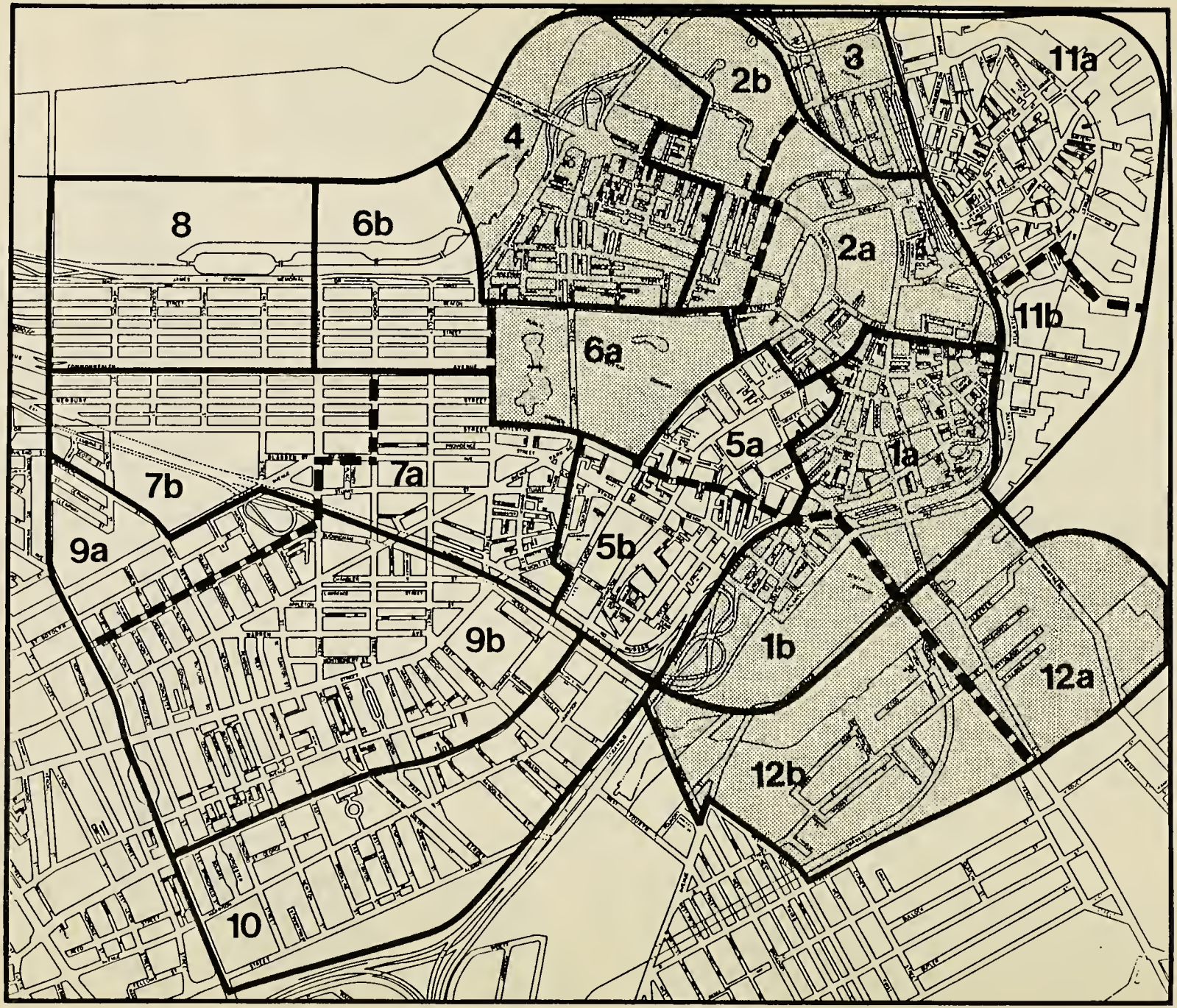
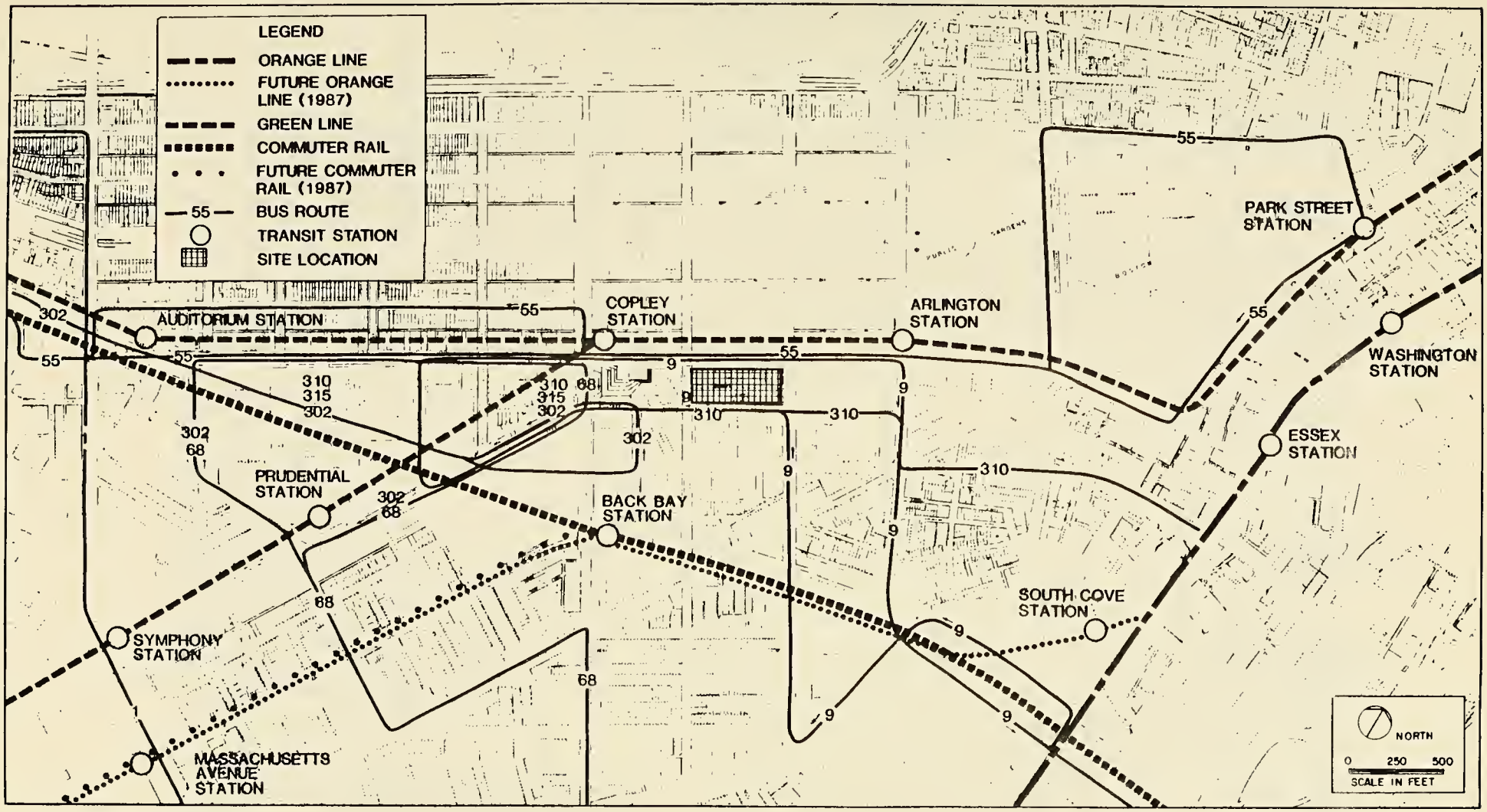


Figure 1.6 Public Transit Facilities



Source: 500 Boylston DEIR

MBTA Green Line - Service from Arlington, Copley, Auditorium, and Prudential Stations to downtown (and connections to other rapid transit lines), Cambridge (Lechmere), and points west and southwest on four lines: Riverside, Boston College, Cleveland Circle, and Arborway. Green Line trains presently run every 6-8 minutes in rush hours, carrying about 10,000 passengers per hour in each direction through Arlington Station.

MBTA Buses - There are presently five express and five local bus routes serving the Area (see Table 1.2). Express service is provided from Burlington (via Haymarket), Watertown (via Newton Corner), and from Roslindale and Needham. Services from Roslindale and Needham will operate until 1987 when the Needham Commuter Rail line reopens.

Commuter Rail - Direct commuter rail service to the Study Area will be restored upon completion of Back Bay Station. At that time, passengers will be able to reach stations along five commuter rail branches (Stoughton, Attleboro/Providence, Franklin, Needham and Framingham) without transferring. Commuter rail passengers from the Area presently must take either a shuttle bus or shuttle train to South Station. In the past, when Back Bay Station was open, commuter rail service carried 9,500 passengers per day through Back Bay.

MBTA Orange Line - Orange Line service to the new Back Bay Station is scheduled to begin in early 1987, providing improved connections to the northeast and southwest inner suburbs. In addition, Orange Line service will provide another connection to the Red Line at Washington Street Station. The future passenger carrying capacity of the Orange Line is

TABLE 1.2

MBTA Routes Serving Study Area

Route Number		Route Description	Trip Time (Minutes)	Frequency in Peak Periods (Minutes) (7-9 a.m./4-6 p.m.)	Frequency in Off Peak (Minutes)	Rapid Transit Station Connections
1	*	Harvard-Dudley via Mass Ave. Will be rerouted when Orange Line opens in 1987.	31-43	6/6	10	Green: Auditorium
9		City Point-Copley via Broadway, Perkins Sq., Herald St., Arlington St. and Boylston St.	16-28	8/9	15-30	Green: Copley Arlington
39/39H	*	Arborway-Copley/Heath St. via South St., S. Huntington Ave., Huntington Ave. Substitutes for Green Line E (Arborway)	18-30	2/4	5-6	Green: Copley
55		Queensberry St.-Park St. via Ipswich St., Boylston, circles Boston Common (return via Stuart St., St. James Ave., Copley Sq., Newbury St.)	14-27	17/30	30	Green: Auditorium Copley
68		Boston City Hospital-Copley via Harrison Ave., W. Dedham St., Dartmouth St., W. Newton St., circles Prudential Ctr.	9-15	35/35	35	Green: Prudential Copley
300		Riverside-Copley/Downton EXPRESS via Financial District, Kneeland St., St. James St., Mass Pike (evening only)	20-22	-	30	Green: Copley

TABLE 1.2 (continued)

MBTA Routes Serving Study Area

Route Number		Route Description	Trip Time (Minutes)	Frequency in Peak Periods (Minutes) (7-9 a.m./4-6 p.m.)	Frequency in Off Peak (Minutes)	Rapid Transit Station Connections
302		Watertown-Copley EXPRESS via Garden St., Newton Corner, Mass Pike, Prudential Ctr.	14-18	12/12	30	Green: Copley
310A (310)	*	Needham-Copley EXPRESS vai Needham Jct., Great Plain Ave./or Highland Ave., Needham Ctr., Mass Pike operates until Needham Commuter Rail line reopens in 1987. (Needham-Downtown Boston operates during non rush hour through Copley Sq.)	28-36	10/10	60	Green: Copley
315	*	Roslindale-Copley EXPRESS via W. Roxbury, Mass Pike, operates until Needham Commuter Rail line reopens in 1987.	44-60	30/30	-	Green: Copley
352		Burlington-Boston EXPRESS via Cambridge St., Rt. 128, I-93, Haymarket Sq. AM: operates to Copley Sq. via Govt. Ctr. and Park Sq. PM: operates from Haymarket, except 1 trip from Copley/Park Sq.	33-43	10/10	-	Green: Copley

* substitute bus service for Green Line (Arborway) or Commuter Rail.

uncertain at this time, as it depends on the number of trains the MBTA is able to provide. Estimated future Orange Line peak hour capacity in previous studies[1] range from 9,600 to 16,000 passengers in each direction. The low end of this range is based on the assumption of 4 car trains operating every 4 minutes; the high end assumes 6 car trains every 3.5 minutes.

Private Buses - Thirteen private bus operators provide service to Copley Square, Park Square, and Prudential from Massachusetts communities. (See Table 1.3) Much of this service is on a limited basis, providing only one rush hour trip per day. However, Marathon Line, Plymouth and Brockton, and Priority Express provide fairly frequent service to western and south shore suburbs. In addition, Boston Double Deckers provides frequent shopper/visitor shuttle service between 10 a.m. and 4 p.m. from Back Bay to Faneuil Hall and Downtown Crossing.

---

[1]500 Boylston Street EIR and a review of this EIR by Steven Kaiser

TABLE 1.3

Private Bus Operators Serving Study Area

Operator	Stop(s) Within Back Bay	Communities Served	Frequency of Service in Peak Periods
Big W Transportation	Park Sq./Copley Sq.	Weston, Wayland, Sudbury, Marlborough, Northborough	1 trip in AM 1 trip in PM
Boston Doubledeckers, Inc.	Prudential/Copley	Faneuil Hall/Downtown Crossing in Boston	None, operates 10-4 daily
Brush Hill Transportation	Greyhound Terminal	Milton, Canton, Stoughton	NA
Englander Coach Lines	Greyhound Terminal	W. Concord, Fitchburg, Athol, Greenfield, Williamstown	NA
Gulbankian Bus	Park Square	Southborough Express	1 trip in AM 1 trip in PM
Hub Bus Lines	Prudential Ctr./ Copley Sq.	Concord/Cambridge	1 trip in AM 1 trip in PM
Hudson Bus Lines	Park Square	Medford, Arlington, Lexington/Stoneham	Hourly
Interstate/Baystate	Park Square	Bridgewater, W. Bridgewater, Middleboro	NA
Kinson Bus Lines	St. James Ave. (near Greyhound terminal)	Topsfield, Ipswich, Newburyport, Amesbury/Boxford, Georgetown, Haverhill	2 trips

TABLE 1.3 (continued)

Private Bus Operators Serving Study Area

Operator	Stop(s) Within Back Bay	Communities Served	Frequency of Service in Peak Periods
Marathon Line	Park Square	Brookline, Newton, Wellesley, Framingham, Worcester	Hourly
Merrimac Transportation	Park Square	Andover, Lawrence	Every 2 hrs.
Plymouth & Brockton Street Railway	Greyhound Terminal	Brockton/Barnstable, Hyannis/Westwood, Milford/Hanover, Pembroke Center/Duxbury, Kingston, Plymouth Center/Hingham, Cohasset, Scituate/Marshfield, S. Duxbury	3-4 trips
Priority Express	Park Square/ Copley Square	Framingham Express	Every 15 minutes

2.0 EXISTING TRAVEL PATTERNS

The Study Area contains a strong residential community and is one of Boston's most important centers of employment, shopping, and tourism. The Study Area's land use, employment, and population characteristics are shown in Table 2.1. The diverse set of activities in the Area generates complex patterns of travel to and within the area, which can best be understood through describing what is known about major types of travellers. These are:

- residents
- commuters
- shoppers
- visitors (e.g. Hynes Auditorium event attendees, people attending business meetings, sales reps, tourists)
- delivery/messenger personnel

Each of these categories of travellers is different in terms of when they arrive and leave, how long they stay, how much they are willing to pay for parking, how far away from their destination they are willing/able to park, and how much delay (both in driving and using public transportation) they are willing to put up with.

Residents

The Study Area contains a residential community with a population of 16,000. The residential community includes 9,500 employed residents who commute to work within the Area and elsewhere. According to the 1980 Census, 73 percent of these people (7,000) work within the City of Boston, and the remaining 27 percent (2,500) commute out to the suburbs. Forty

TABLE 2.1

Land Use, Employment, and Population Characteristics

Land Use

10,000,000 sq. ft. of office space[1]

1,300,000 sq. ft. retail space[1]

5,000+ hotel rooms[1]

Population and Employment

50,000 employees[2]

16,000 residents[3]

9,500 employed residents[3]

---

1. Figures from Cambridge Systematics, "Parking in Central Boston: Meeting the Access Needs of a Growing Downtown", prepared for Boston Traffic and Parking Department, December 1983; adjusted for new development between 1983 and 1986.

2. Estimated based on CTPS information provided in: Cambridge Systematics, Inc., "Downtown Crossing Auto Restricted Zone in Boston" report prepared for U.S. Department of Transportation, July 1982; and application of downtown Boston average ratio of 200 sq. ft. per employee to Back Bay office square footage.

3. 1980 Census: tracts 106, 107, and 108

percent of employed residents in the Study Area walk to work; 34 percent take public transportation, and 26 percent drive.

Residents also account for a significant number of the shopping trips within the Study Area. One survey of shoppers at Prudential Center, Copley Place and Newbury Street indicated that 19% of shoppers were residents.

Commuters

Approximately 50,000 persons are employed in the Study Area, or 17 percent of Boston Proper's work force. The Prudential Center, the John Hancock Building, and Copley Place are the major employment sites, collectively accounting for 50 percent of the area's office space. Based on surveys of Boston office building employees,[1] an estimated 12,500 (25 percent) of these employees live in the City of Boston. As shown in Table 2.2, over one half of the Study Area commuters (28,000) take public transportation to work. Thirty-seven percent drive to work, resulting in 9,700 commuter vehicles into and out of the Study Area each day. Seven percent of Back Bay employees (3,500) walk to work.

Shoppers

The Study Area contains 1.3 million square feet of retail floor space,[2] 40 percent of which is

---

[1]Boston Redevelopment Authority Research Department, "The Office Industry Survey, Part II: An Analysis of Office Tenant Responses", March 1979.

[2]Cambridge Systematics, "Central Boston Retail Patterns, Part 1: Retail Sales" prepared for Boston Prudential Center Project, Prudential Development Company, August 1985.

TABLE 2.2

Commuting to the Study Area

Total Number of Commuters[1]	Number (Percent) Commuting by Auto[2]	Number of Commuter Auto Trips[2]	Number (Percent) Commuting by Public Transit[2]	Number (Percent) Walking/ Bicycling[2]
50,000	18,500 (37%)	9,700	28,000 (56%)	3,500 (7%)

1. Figures from Cambridge Systematics, "Parking in Central Boston: Meeting the Access Needs of a Growing Downtown", prepared for Boston Traffic and Parking Department, December 1983; adjusted for new development between 1983 and 1986.

2. Source: Travel Assumptions from the 500 Boylston EIR which were based on surveys of 3,000 Back Bay employees.

located in the Prudential Center and Copley Place. While there are no figures available on the number of daily shoppers visiting the Area, application of a standard ratio of shopper visits per 1,000 square feet yields an estimated 20,000 daily shopping trips.[1]

Many of these shopping trips are made by the "captive" market of Study Area employees, residents, hotel guests, and other visitors who come to the Area primarily for reasons other than shopping.

Surveys conducted of shoppers at Copley Place, Newbury Street, and Prudential Center show that the proportion of shoppers who are "captives", (as opposed to those whose primary purpose for coming to the Area is to shop) varies significantly by time of year. The proportion of captives was 43 percent in an August, 1985 survey, but dropped to 25 percent in a survey conducted at the height of the Christmas shopping season in December, 1985.[2]

The August survey (which represents more typical conditions than the December survey) found that 13 percent of the shoppers were area employees, and 19 percent were residents of the Study Area. It also found that 46 percent of the shoppers walked to reach the location at which they were interviewed, 27 percent drove or took a taxi, and 27 percent took public transportation (primarily the MBTA Green Line).

---

[1]15.6 visits/1,000 sq. ft.-used in the 500 Boylston and Copley Place EIR's.

[2]First Market Research, "A Profile of Late August Visitors to Copley Place, Newbury Street, and the Prudential Center", conducted for Clarke and Company, August 1985. 503 interviews were conducted in this survey.

Visitors

The Study Area attracts a large number of visitors--to office buildings, hotels, and the various educational and cultural institutions, including the Hynes Auditorium and the Boston Public Library. While no hard data is available on the number of daily visitor trips to the Area, application of standard ratios of visitors per 1,000 square feet of office, and per hotel room yield estimates of 25,000 daily office-related and 17,500 daily hotel-related visitor trips.[1] A sizeable portion of hotel trips are by taxi--surveys conducted at the Colonnade and Sheraton Hotels found that 34 percent of auto arrivals were by taxi.[2]

The Hynes Auditorium will be a major generator of visitor trips to the Study Area. As shown in Table 2.3, the number of daily trips to past Hynes events has varied from 1,370 to 26,000. Consumer gate shows--which will be considerably less frequent when the new Hynes opens--are by far the largest trip generators.[3] The percent of Hynes visitors who drive also varies considerably according to the type of event--from 40-50 percent for regional and national conventions, to 80-90 percent for consumer gate and regional trade shows.

Delivery/Messenger Vehicles

As with visitor trips, there are no hard numbers on the number of deliveries to the Study Area. Application of standard truck trip

---

[1]Ratios of 2.5 daily visitors per 1,000 square feet of office; 3.5 daily trips per hotel room from the Copley and 500 Boylston EIR's.

[2]Norm Abend studies for Copley Place.

[3]The number of gate show event days will be reduced by 70 percent, according to the Hynes EIR.

TABLE 2.3

Hynes Auditorium Event Travel

Type of Event (Source of Data)	Daily Attendance (including exhibitors)	Maximum Persons Present at Any One Time	Percent Arriving by Auto
Regional Convention (New England Hospital Assembly)	6,150	4,320	50%
National Convention (National Association of Savings Institutions)	1,370	1,096	40%
Consumer Gate Show (Home Show)	26,000	8,500	80%
Regional Trade Show (Boston Gift Show)	5,700	4,560	90%

Source: Hynes Auditorium EIR

generation rates[1] to land use yields an estimated 3,000 daily truck trips to the Study Area. Loading has been identified as a significant problem in the Study Area, both due to truck traffic adding to congestion, and to inadequate on street loading areas, particularly along Boylston and Newbury Streets. The result is significant double parking which increases traffic circulation problems. Growth in overnight package delivery services in recent years has added to these problems.

---

[1]Truck trip rates of 0.21 daily trips per 1,000 sq. ft. office; 0.24 daily trips per 1,000 sq. ft. retail from the 500 Boylston EIR.

3.0 TRANSPORTATION CONDITIONS AND KEY DEFICIENCIES

Existing information on how the Study Area's transportation system is handling the various demands placed on it is organized according to the three critical system components: streets/traffic, parking, and public transportation.

Streets/Traffic

Traffic conditions in the Study Area have been evaluated in a number of recent studies:

- the 500 Boylston EIR-October 1984
- the Hynes Auditorium EIR-August 1984
- the 1985 Back Bay Traffic/Transportation Study (conducted by HMM Associates for the City of Boston)-August 1985
- the Back Bay Origin-Destination Survey (conducted by TAMS for the Boylston Zoning study)-December 1985
- the review of the 500 Boylston EIR (conducted by Steven Kaiser for Citizens for a Better New England Life)-June 1985

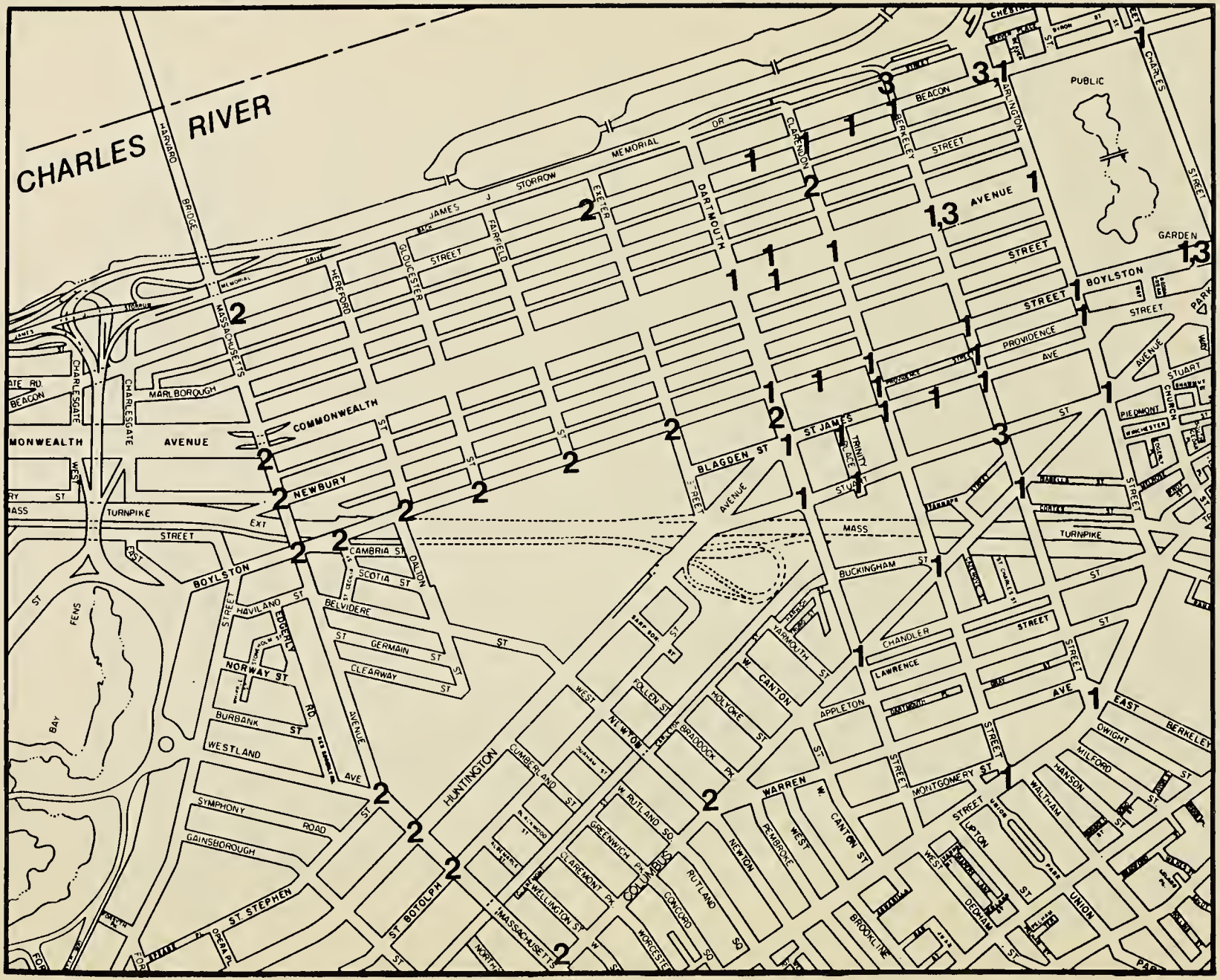
Traffic analysis in these studies has included:

- traffic counts at intersections and selected mid block locations
- analysis of intersection congestion levels (level of service)
- qualitative observation/analysis of traffic problems

Key findings, inconsistencies, and data gaps in each of these areas is summarized below.

Traffic Counts - Figure 3.1 the locations where recent (1983-85) traffic counts have been made. While fairly up-to-date information on traffic volumes is available for all major signalized intersections, most of the counts were conducted during 1983-84, and do not fully reflect the

Figure 3.1 Traffic Survey Locations 1983-85



effect of two major developments--Copley Place and the State Transportation Building. The 1985 HMM Back Bay Traffic/Transportation Study attempted to address this problem by factoring up the 1983/84 traffic counts to reflect the impacts of these two developments, based on 1985 counts at a few locations. The HMM traffic data base is the most recent and complete one available; however, it has been criticized for showing traffic volumes that are too high because the assumptions used to factor up actual counts in 1983-84 to 1985 conditions were not backed up by actual new counts in a sufficient number of locations. In addition, a review of the counts by TAMS revealed that they were not "balanced"--that is, the number of vehicles leaving one intersection and entering an adjacent one did not match in many locations. TAMS corrected this deficiency for a small part of the street network (Berkeley to Clarendon between Beacon and Stuart). The HMM traffic counts, the TAMS corrections, and more detailed documentation of recent traffic counts are provided in Appendix A.

Congestion Levels - Congestion levels are analyzed by measuring the volume of traffic at specific intersections and comparing this volume to a theoretical intersection capacity, which is derived based on physical factors such as the width of the streets and operating characteristics such as parking regulations in effect, and how the traffic signal is timed. Volume to capacity (or V/C) ratios are then calculated to quantitatively describe the amount of traffic congestion. Based on these V/C ratios, intersections are classified into six "level of service" categories, designated by the letters A-F. Level of service "A" represents free flow conditions with little or no delays (for example, the intersection of Beacon and Exeter), while level of service "F" represents

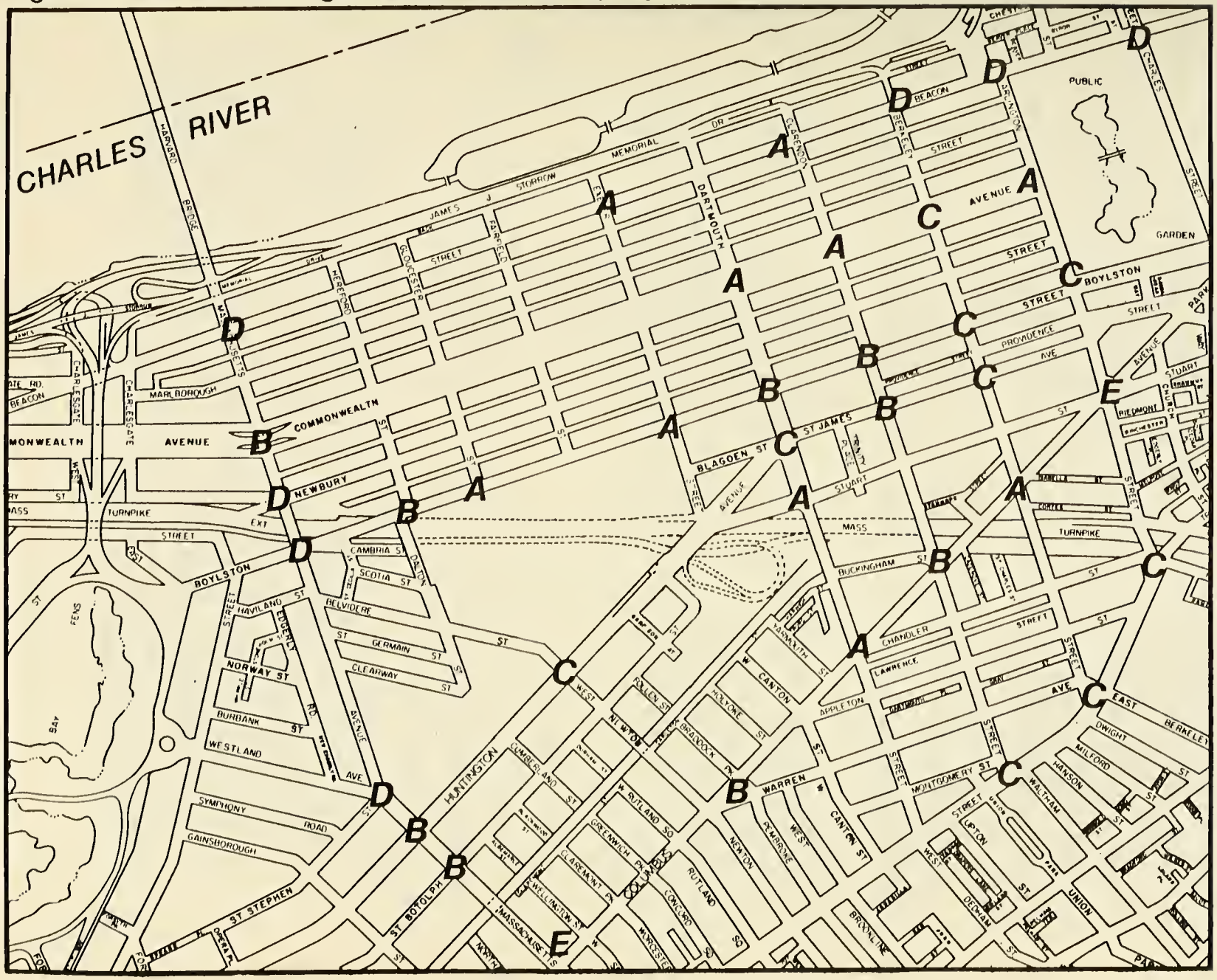
stop-and-go congestion, where the average driver will spend over a minute (and many will spend more time) getting through the intersection. Levels of service A-C are generally considered acceptable--in fact, most intersections are designed to operate at level of service C. Levels of service D and E are also considered by traffic engineers to be tolerable "in small doses"--for short periods of time during rush hour. However, at these congestion levels, drivers experience noticeable amounts of delay and frustration, and factors such as a jaywalking pestrian, a pothole, or a car making a turn from the wrong lane can cause traffic backups.

Figure 3.2 presents information from recent studies on Study Area congestion levels.[1] Virtually all of the studies agree that traffic volumes are highest during the afternoon rush hour (4:30-5:30 p.m.), when commuters, shoppers and visitors are leaving. Thus, the analysis of intersection service levels in all studies has been conducted for this time period. According to these studies, most intersections operate with acceptable levels of congestion (level of service A-C). Nine intersections operate at level of service D or E, and none are at F. The "problem" intersections are at points of entry to the area, where large numbers of vehicles are seeking access to Storrow Drive, the Southeast Expressway, or Massachusetts Avenue. The traffic analyses indicate that there are no significant problems getting around within the Back Bay grid of streets.

---

[1]For some intersections, different studies showed different congestion levels for the same intersection. In those instances, the "worst case" level was assumed. Documentation of these inconsistencies is provided in Appendix A.

Figure 3.2 Intersection Congestion Levels 1983/84 (PM peak hour)



Key

A: Free Flow

B: Speed somewhat restricted

C: Some vehicles must wait through one light

D: Moderate Congestion

E: Severe Congestion

F: Forced flow conditions

For many of the problem intersections, operational and circulation changes have been identified to improve conditions. For example, the HMM study stated that enforcement of peak period parking restrictions, improved signing, and restriping could improve the operation of the Berkeley/Beacon intersection, now at level of service D, to level of service C. The HMM Report also determined that the Arlington/Stuart/Columbus intersection, now at level of service E could be improved to level of service C with relocation of a taxi stand and enforcement of parking regulations. It is important to note, however, that these "bandaid" approaches to traffic problems have been criticized because they don't account for the possibility that when conditions are improved, traffic levels will increase to the pre-improvements levels. This is a well known phenomenon in urban areas, where the demand for road space far exceeds the supply, and improvements in capacity may cause shifts from alternate routes or public transit.

Qualitative Problem Assessments - A number of traffic problems have been identified in a qualitative manner which are not reflected in the more quantitative, engineering-oriented measurements of intersection congestion. These include:

- Traffic backups from certain intersections which are long enough to block adjacent intersections. These occur primarily on Berkeley Street from Storrow Drive to the Beacon Street intersection, on Boylston Street from Tremont to the Arlington Street intersection, and on Arlington Street from Herald Street (access to the Southeast Expressway) to the Stuart/Columbus intersection. These backups are of particular concern as they have the potential to result in gridlock. The Steve Kaiser review of the 500 Boylston EIR documented a gridlock incident which occurred in May, 1985, in which traffic was tied up in a complete loop around the Public Gardens--from Charles Street to Stuart, across to Arlington Street, up Arlington Street to Beacon, and back to Charles.

- Restricted traffic movement due to double parked vehicles and loading/unloading activity. This problem is particularly evident on Newbury and Boylston Streets, and results from the combination of insufficient loading areas and inadequate parking enforcement.

- Conflicts between pedestrians and cars at high pedestrian volume intersections. These result both in traffic delays due to jay-walking pedestrians, and impaired pedestrian mobility and safety in crossing streets. Locations where these conflicts are most significant are: Boylston at Berkeley, Clarendon, Dartmouth, and Tremont; and Dartmouth at Stuart and St. James/Huntington Avenue.

- Traffic volume levels on the primarily residential streets are considered by residents to be too high, because of concerns about noise, safety, and ease of movement (both on foot and by car) to and from their homes. Traffic on Berkeley Street is of particular concern, as it has increased because of the reversal of Charles Street.

- Traffic which travels <u>through</u> the Study Area has also been identified as a concern. As congestion on Storrow Drive and the Central Artery worsens in the future, increases in through traffic are likely to occur. While no attempt has been made to measure the extent of east-west through traffic, a recent study by TAMS looked at through traffic on Berkeley and Clarendon Streets. This study found that 29 percent of vehicles entering Berkeley Street at Stuart were bound for Storrow Drive, and 18 percent of the vehicles that entered Storrow Drive from Berkeley Street got onto Berkeley south of Stuart Street.

<u>Parking</u>

Information on parking availability in the Study Area was assembled from data collected for the City of Boston 1983 parking study, more recent counts conducted for the Hynes and 500 Boylston EIR's, and counts of cars in the Prudential garage made in December 1984. The only major gap in parking information is that there have been no utilization counts for the Copley Place garages, which contain over 1,400 spaces. Peak utilization (the percent of spaces filled at midday) for all parking facilities other than Copley Place are provided in Table 1.1.

Of the 10,976 off-street parking spaces in the Study Area, 81 percent are occupied at midday, which is generally when facilities reach their peak occupancy. This means that about 2,000 spaces are available at this time. Parking availability is presently quite good in the Prudential Center area--particularly now that the Hynes Auditorium is under construction. However, the Hynes Auditorium has in the past been a major generator of parking demand in the area--a gate show can fill all parking facilities in the area, including the Prudential and Cheri garages to capacity.[1] Despite planned future reductions in the number of gate shows, the Hynes is likely to continue to be the source of significant fluctuations in parking usage in the area.

While there is some available capacity in off street parking facilities, parking on the street is much more difficult. The last on-street parking survey in Back Bay was conducted in 1983, and found that virtually all spaces were full at midday. On street spaces are clearly more desirable than off-street spaces because they are less expensive and more convenient.

Past surveys of shoppers, employees, and visitors illustrate this point:

- 44 percent of shoppers interviewed at Copley Place and the Prudential Center had parked on the street, despite the availability of large convenient parking garages at these locations.[2]

---

[1]Vanasse Hangen Associates, "Hynes Auditorium Parking Study: Existing Conditions", memorandum prepared for Massachusetts Convention Center Authority, May 1984.

[2]First Market Research, "A Profile of Late August Visitors to Copley Place, Newbury Street, and the Prudential Center" prepared for Clarke & Company, August 1985.

- 29 percent of employees surveyed in 1983 at 500 Boylston Street parked on the street, despite the availability of over 100 spaces in the St. James Garage at the time of the survey.[1]

- 25 percent of attendees surveyed at a consumer gate show in 1984 had parked on the street.[2]

The demand for on street spaces far exceeds the supply in the Study Area, and probably always will. Institution of resident permit parking in the Study Area in 1983 improved the parking situation for residents, but undoubtedly made conditions tighter for shoppers and visitors.

Public Transportation

Green Line - The MBTA Green Line is by far the largest component of public transportation service to the Study Area, and crowding, unreliable, and confusing conditions on this line is the Area's biggest public transportation deficiency. In 1982 (the most recent year for which data is available to indicate use of Back Bay stations) 23,000 passengers boarded and alighted at the four Back Bay stations on an average day. More recent (1985) information is available on Green Line ridership on trains passing through Arlington Station. As can be seen in Table 3.1, 8,691 outbound passengers travelled through the Area during the p.m. peak hour. Based on this ridership level, it has been estimated that 81 percent of the available space on trains (including standing room of 2 square feet per passenger) is full. This level of use has been described as "sardine conditions" by one source.[3]

---

[1]Cambridge Systematics, "Parking in Central Boston: Meeting the Access Needs of a Growing Downtown", December 1983.

[2]Vanasse/Hangen, "Hynes Auditorium Parking Study, Existing Conditions", May 1984.

[3]Steven Kaiser, "Transportation Review of the 500 Boylston Street Development", June 1985.

TABLE 3.1

Green Line Ridership at Arlington Station
(outbound, p.m. peak)

Branch	Capacity[1]	Counted Riders[2]	Volume to Capacity Ratio
'B' Boston College	2,880	2,369	.82
'C' Cleveland Circle	3,040	2,410	.79
'D' Riverside	2,880	2,370	.82
'E' Arborway	1,900	1,542	.81
	10,700	8,691	.81

1. Estimated based on an assumed capacity of 160 passenger per LRV car, and 100 passengers per PCC car.

2. 1985 MBTA peak load counts

Source: HMM Associates, "Back Bay Neighborhood Transportation and Traffic Engineering Study", August 1985.

In addition to the crowding problem, the Green Line suffers from unreliable service, inadequate signing to direct passengers to appropriate trains, and a confusing system of train scheduling (for example, the destination of inbound trains from Back Bay varies and is often not clearly delineated on trains). A look at past trends on the Green Line (see Table 3.2) shows that these problems, in combination with the fare increases in 1980 and 1981 have contributed to a dramatic decline in ridership. The number of passengers at Back Bay stations was 38 percent lower than in 1972.

Other Services - The primary problem with other public transportation services to the Study Area is that there aren't enough of them. Significant improvements will occur with the opening of Orange Line Back Bay service, and the restoration of direct commuter rail connections. Addition of new bus routes--particularly express services, and increased frequency of evening services would provide more convenient public transit options for many employees, shoppers and visitors.

TABLE 3.2

Ridership Trends at Back Bay Green Line Stations-1982 One Day Count
(turnstyle counts)

Year	Arlington	Copley	Auditorium	Prudential	TOTAL
1972	16,559	11,191	7,006	3,020	37,776
1973	14,513	11,522	7,027	2,889	35,951
1974	11,403	11,382	7,278	2,737	32,800
1975	11,089	11,136	5,911	2,271	30,407
1976	11,303	11,630	7,400	2,147	32,480
1977	10,339	12,933	6,063	1,868	31,203
1978	11,437	13,064	7,107	1,939	33,547
1979	10,444	12,355	7,588	2,524	32,911
1980	6,438	8,455	4,319	926	20,138
1981	6,234	9,352	3,299	698	19,583
1982	7,091	9,379	4,980	1,851	23,301

4.0 IMPACTS OF DEVELOPMENT ON TRANSPORTATION CONDITIONS

This chapter summarizes past and future development trends in the Study Area, reviews the impacts of past developments on traffic and public transit usage, and synthesizes what impacts have been projected for future developments--both on an individual and cumulative basis.

Development Trends 1972-1990

Table 4.1 lists the developments which have occurred since 1972, and which are now either under construction or committed to be constructed by 1990. The list is broken down into three categories: developments completed between 1972 and 1982 whose full impacts are now apparent, those completed recently between 1983 and 1985 and may not be fully occupied, and those scheduled to be completed between 1986 and 1990.

The decade between 1972 and 1982 was a relatively slow period for development in the Study Area. Major developments during this time were the Hancock Tower with 2 million square feet, a 428 room addition to the Sheraton Hotel, and the Back Bay Hilton with 375 rooms. A total of 2.2 million square feet and 803 hotel rooms were constructed in this period.

The 1983-1985 period was a boom time for development. In this three year period, Copley Place, the State Transportation Building, and several smaller projects exceeded the total floor space added in the previous ten years. A total of 2.7 million square feet of office and retail space, about 2,000 hotel rooms, and 150 residential units was completed in this period.

In the 1986-1990 period, two major developments will be completed--the New England Life project and the Hynes Auditorium expansion. In addition, smaller projects in this period include the Heritage-on-the-Garden

TABLE 4.1
Development 1972-1990

1972-1982	Office (1,000 sq. ft.)	Retail (1,000 sq. ft.	Hotel (rooms)	Residential (dwelling units)	Other
545 Boylston (1973)	85				
Hancock Tower (1974)	2,000				
Vendome Hotel Conversion (1975)				120	
Sheraton Addition (1975)			428		
Salada Tea Rehab. at 155 Berkeley St. (1981)	103				
Back Bay Hilton (1982)			375		
TOTAL 1972-82	2,188	-	803*	120	
1983-1985					
Copley Place (1983-84)**	645	270	1,945		
State Transportation Bldg. (1983-84)	600	60			
Park Square Addition (1983)	120				
One Exeter Place (1985)	195	10			
399 Boylston (1985)	210	12			
Four Seasons Hotel (1985)	290			100	
Mt. Vernon Church (1985)				50	
Hancock Renovation (1985)	250				
TOTAL 1983-85	2,310	352	1,945	150	
1986-1990 (under construction/committed)					
Prince School				35	
855 Boylston (Ingalls Bldg.)	150				
Heritage-on-the-Garden	120	45		100	
Additional Copley Place Occupancy	200	30		100	
Hynes Auditorium (net change)					136,000 sq. ft.
500 Boylston (New England Life)	1,200***	100			
739 Boylston (rehab)	N/A				
Tent City		10		270	
TOTAL 1986-90	1,670	185	-	505	

* Net increase was 503, due to a loss of 300 rooms from the Somerset Hotel.

** Copley Place will reach full occupancy in 1987; additional square footage listed under 1986-1990 categories.

*** Net increase of 900,000 sq. ft.

(Arlington/Hadassah) office/retail/condominium project, the Ingalls building at 855 Boylston and the Tent City housing project. Also included during this period was additional occupancy at Copley Place scheduled to occur by 1987.

Total development in the 1986-1990 period will add 1.9 million square feet of office and retail space, 505 residential units and a net increase of 136,000 square feet of auditorium/convention space due to the expansion of Hynes. In comparison to the previous two periods, the increase in office/retail space in the 1986-1990 period is lower, equaling 85 percent of the 1972-1982 square footage increase and 70 percent of the 1983-1985 increase. On the other hand, the amount of new residential development in 1986-1990 exceeds that which occurred in the thirteen years between 1972 and 1985.

Impacts of Past Developments: A Review of Transportation Trends

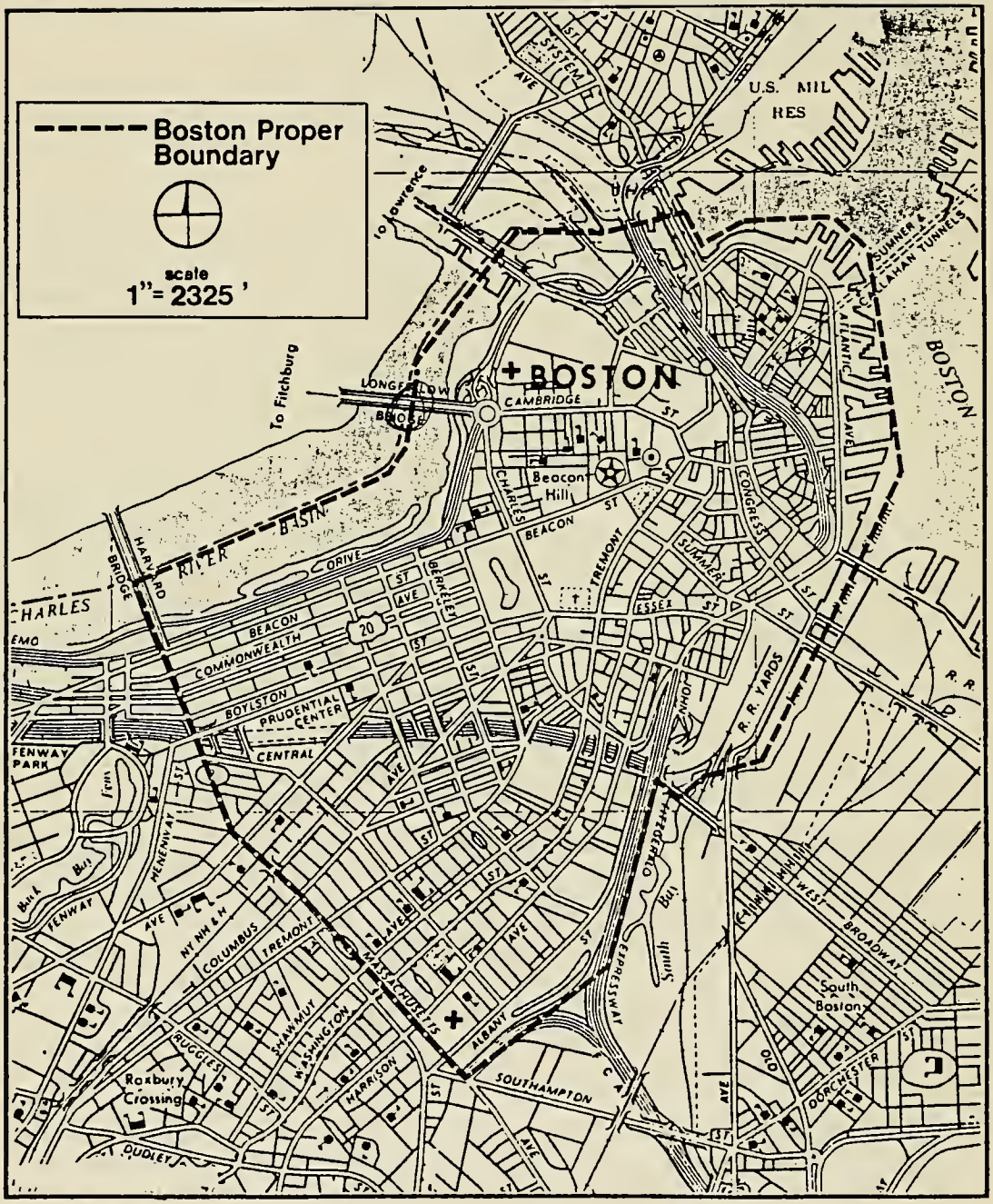
Unfortunately, no studies have been done in the past specifically for the purpose of determining the impacts of individual developments. One must instead rely on information on trends in traffic and public transportation use which has been collected by EIR's for other purposes. Information on trends is available from the following sources:

- the 1972 and 1982 Boston cordon counts, which measured the number of people crossing a ring around to Boston Proper (the cordon line) in cars, on public transportation, and on foot during a one-day period. (See Figure 4.1 and Tables 4.2 and 4.3 for summaries of cordon count information.)

- traffic counts at intersections assembled in the Copley Place, 500 Boylston, and Hynes EIR's (see Table A.3).

- Green Line station turnstyle counts (available for each year between 1972 and 1982) for Back Bay and all of Boston Proper (see Table 3.2).

Figure 4.1 Cordon Count Boundary for Boston Proper, 1982



Source: CTPS

TABLE 4.2

Changes In Travel To/From Boston Proper 1972-1982

Daily Trips (6 AM-12 Midnight)

		1972		1982		Change	
Vehicle Trips:	Persons	1,287,625	(69%)	1,359,658	(69%)	72,033	(+6%)
	Vehicles	844,141		969,150		125,009	(+15%)
Transit Trips		494,838	(27%)	523,719	(26%)	28,881	(+6%)
Pedestrians/Bicycles		79,469	(4%)	94,089	(5%)	14,620	(+18%)
Total Persons		1,861,932	(100%)	1,977,466	(100%)	115,534	(+6%)

AM Peak Period Trips (7-9 AM)

		1972		1982		Change	
Vehicle Trips:	Persons	159,804	(56%)	190,292	(58%)	30,488	(+19%)
	Vehicles	116,644		144,151		27,507	(+24%)
Transit Trips		116,202	(41%)	126,229	(38%)	10,027	(+9%)
Pedestrians/Bicycles		7,294	(3%)	12,659	(4%)	5,365	(+74%)
Total Persons		283,300	(100%)	329,180		45,880	(+16%)

PM Peak Period Trips (4-6 PM)

		1972		1982		Change	
Vehicle Trips:	Persons	218,302	(60%)	206,677	(59%)	-11,625	(-5%)
	Vehicles	131,980		142,728		10,748	(+8%)
Transit Trips		133,859	(36%)	127,366	(36%)	-6,493	(-5%)
Pedestrians/Bicycles		14,694	(4%)	17,378	(5%)	2,684	(+18%)
Total Persons		366,855	(100%)	351,421		-15,434	(-4%)

TABLE 4.3

Changes In Traffic Crossing Massachusetts Avenue 1972-1982

Daily Traffic (6 AM-12 Midnight)

	1972	1982	Change	
Storrow Drive	84,530	81,547	2,983	(4%)
Mass Pike Extension	64,581	88,997	24,416	(+38%)
Local Streets:				
Beacon	12,176	6,384	-5,792	(-48%)
Marlborough	1,965	2,168	203	(+10%)
Commonwealth	29,367	30,073	706	(+2%)
Newbury	859	1,592	733	(+85%)
Boylston	12,656	11,649	-1,007	(-8%)
Huntington	19,859	21,126	1,267	(+6%)
Columbus	18,245	14,079	-4,166	(-23%)
Total-Local Streets	95,127	87,071	-8,056	(-8%)

AM Peak Period Traffic (7-9 AM)

	1972	1982	Change	
Storrow Drive	10,200	12,026	1,826	(+18%)
Mass Pike Extension	11,777	15,982	4,205	(+36%)
Local Streets:				
Beacon	1,106	716	390	(-35%)
Marlborough	310	236	74	(-24%)
Commonwealth	3,008	3,420	412	(+14%)
Newbury	97	139	42	(+43%)
Boylston	1,438	1,624	186	(+13%)
Huntington	2,141	2,810	669	(+31%)
Columbus	2,579	2,475	104	(-4%)
Total-Local Streets	10,679	11,420	741	(+7%)

PM Peak Period Traffic (4-6 PM)

	1972	1982	Change	
Storrow Drive	13,020	11,610	-1,410	(-11%)
Mass Pike Extension	12,690	15,927	3,237	(+26%)
Local Streets:				
Beacon	2,098	1,051	-1,047	(-50%)
Marlborough	380	506	126	(+33%)
Commonwealth	3,809	4,730	921	(+24%)
Newbury	139	240	101	(+73%)
Boylston	2,223	1,583	-640	(-29%)
Huntington	2,975	3,136	161	(+5%)
Columbus	2,864	2,149	-715	(-25%)
Total-Local Streets	14,488	13,395	-1,093	(-8%)

Key trends between 1972 and 1982 were:

Travel to Boston Proper

- Development in all of Boston Proper between 1972 and 1982 added 13 million square feet of office and retail space, 5,000 residential units, and about 400 hotel rooms. If standard trip generation rates were applied, one would estimate that this development would attract about 200,000 trips per day (inbound and outbound). However, the 1972 and 1982 cordon counts show an increase in daily person crossings into and out of Boston Proper of only 116,000 (or 6%) and this number includes an increase in travel through Boston. These figures show that a significant portion of the activity generated by new development is internal to Boston as opposed to suburb-to-Boston oriented. This is consistent with the population increases in Boston Proper and changes in the demographic characteristics of the population (more people both live and work in Boston) between 1970 and 1980.

- Public transportation carried the same proportion of people in 1982 as in 1972, and the number of trips on public transit increased by six percent. This shows a reversal of pre-1972 trends of declining transit use, both in total numbers and proportion.

- Twenty-five percent of the increase in person trips between 1972 and 1982 was accommodated on public transportation.

- The overall increase in public transit use occurred despite a significant decline in rapid transit and street car ridership. These modes lost over 50,000 daily riders between 1972 and 1982, which represents a 13 percent decrease. This loss was made up for by a dramatic 157 percent increase in bus passengers. In 1972, buses accounted for just 10 percent of all public transportation trips while in 1982, the bus share increased to 25%.

  Commuter rail ridership also picked up some of the decline in rapid transit, increasing by 21 percent. In addition, the number of people walking into Boston increased by 18%. The decline in rapid transit ridership reflects growth of outlying suburbs not served by rapid transit and streetcar lines, the July 1981 rapid transit fare increase from 25¢ to 50¢, and (some believe) deterioration of service levels and reliability.

- A majority of the 116,000 new trips between 1972 and 1982 were made in cars. Overall, traffic into and out of Boston increased by 15 percent though this increase was not uniform across different roadways. The Mass Pike Extension and the Summer/Callahan Tunnels experienced the largest traffic increases (38% and 24% respectively). On some facilities, traffic actually decreased--for example, traffic on Storrow Drive (at Mass Ave.) was down by 4%, traffic on the Longfellow Bridge declined by 6%.

- A sizeable portion of the increase in traffic may be attributable to a decline in ridesharing--the number of people travelling by car increased by 6 percent, while the number of vehicles increased by 15 percent, indicating a drop in the average number of people per car from 1.53 to 1.40.

- Traffic increases were much higher in the morning peak period than in the evening. This is because traffic congestion is worse in the evening and many facilities are at a saturation point. This has resulted in spreading of the afternoon rush hour.

The most important conclusion to be drawn from these trends is that development is only one of many factors determining the magnitude and pattern of traffic changes. Demographics, the spatial distribution of metropolitan area population growth, the quality and cost of public transportation service, and the level of ridesharing are also major determinants of traffic growth. A second important observation is that improvements to Boston's rapid transit system and further expansion of express bus and commuter rail services will be critical to accommodating future growth, particularly given the fact that many of the major highways which absorbed growth in the past are reaching a saturation point.

Travel to Study Area

Trends for the Study Area are more difficult to isolate. However, the following facts are known:

- Daily traffic crossing Massachusetts Avenue into and out of Back Bay on local streets decreased by eight percent between 1972 and 1982. Storrow Drive traffic across Mass Ave. has also decreased--by four percent. However, this does not mean that total traffic into the Area has decreased--major entry and exit points from Storrow Drive (ramps at Arlington, Berkeley, and Clarendon Streets), the Mass Pike, and the Southeast Expressway were not included in the cordon count, and information on changes in traffic entering at these locations is not available. It is very possible that a portion of the overall traffic increases which have occurred on the Mass Pike, the Southeast Expressway, and the Sumner and Callahan Tunnels is due to traffic bound for the Study Area.

- Comparative traffic counts for 1973-77 and 1981-85 are available for 15 locations (See Figure 4.2). These counts show only four places where traffic significantly increased (by more than 10 percent). Traffic decreased significantly in two locations. Most of the internal traffic changes can be attributed to modifications in circulation patterns, and construction activity occurring during this period. For example, the reversal of Charles St. north of Beacon resulted in a dramatic rise in traffic at the Arlington/Beacon intersection. It also caused traffic to increase on Berkeley St. The Southwest Corridor Project, the initiation of construction of Back Bay Station, and the construction of Copley Place and associated reconfiguration of the Mass Pike ramps affected traffic on Columbus Ave., Dartmouth, and Stuart Streets.

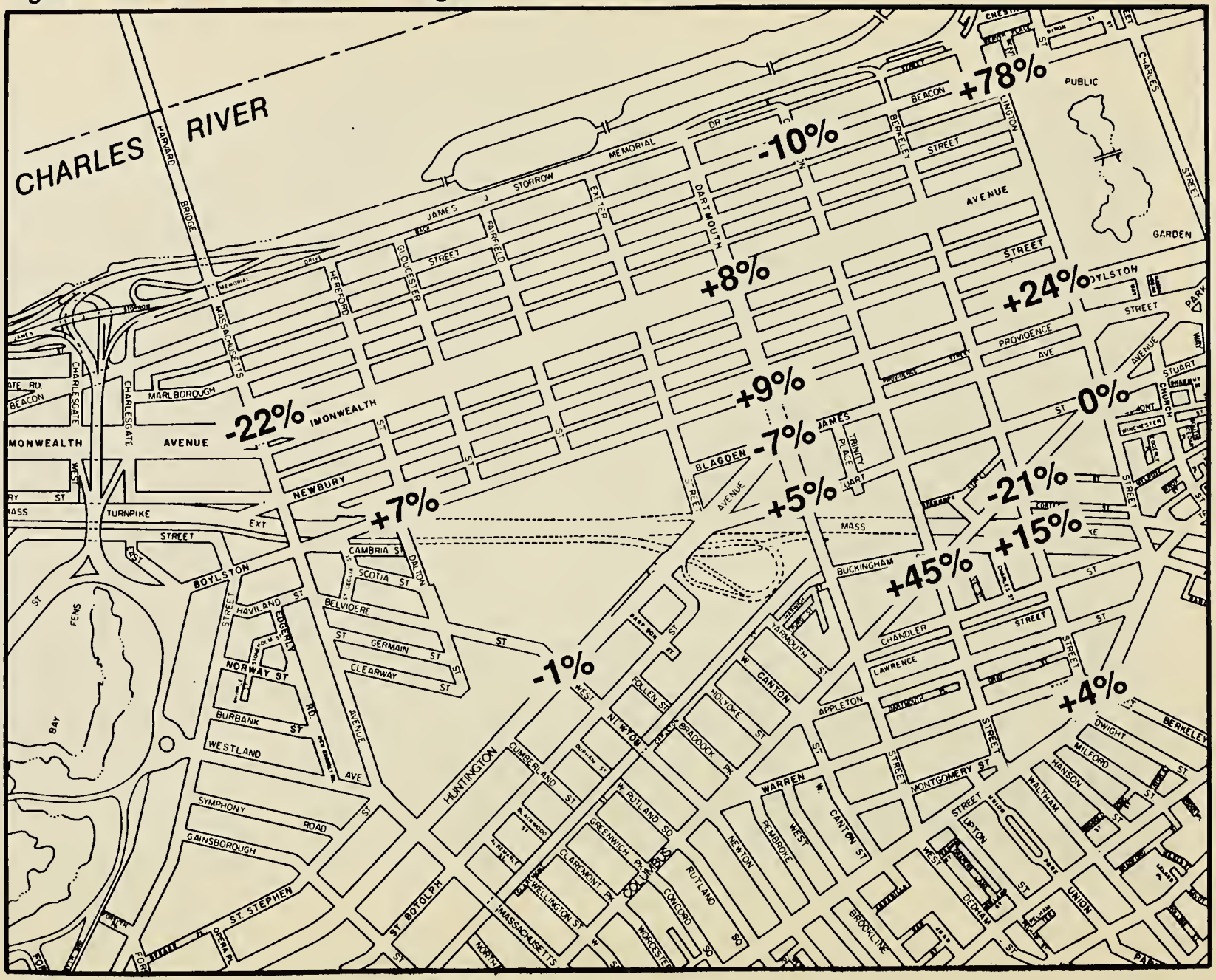
- Recent studies (the HMM Traffic/Transportation study and the review of the 500 Boylston EIR by Steven Kaiser) have stated that traffic in the Study Area has incresed significantly in the 1983-1985 period due to Copley Place and the State Transportation Building. More recent traffic counts are needed to conclusively determine that this has been the case.

- Green Line ridership at the four Back Bay stations declined by 14,000 daily passengers between 1972 and 1982--a 38 percent drop. Historical information on bus and commuter rail ridership was not available for this review.

- Significant demographic changes occurred in the Study Area between 1970 and 1980. While the population was stable, there was a five percent increase in the number of employed residents, and a 50 percent increase in the number of employed residents working in the Boston Central Business District. The student-aged (15-24) population decreased by 30 percent, while the percent of owner-occupied units increased from four percent in 1970 to 20 percent in 1980 and the percent of residents living in the same unit for at least five years increased from 19 percent to 23 percent. These trends show a transition to an older, less transitory population, and towards more people who both live and work in Central Boston.

To summarize, it is likely that traffic to the Study Area via the Mass Pike, the Southeast Expressway, and Storrow Drive (from the Central Artery) has increased, between 1972 and 1982, though the magnitude of the increase cannot be determined. Demographic changes in the Study Area during this period indicate that a growing share of the new trips generated by development were trips within the Study Area as opposed to those

Figure 4.2 PM Peak Hour Traffic Changes: 1973-77 to 1981-85*



*Comparison dates vary for each intersection; see Table A-3.

coming from the outside (which contribute to the traffic problems which are primarily access related). The changes in traffic volumes within the Study Area can be better explained by the modifications to circulation which have been made than by the location of new development.

Conclusions for the Study Area are similar to those stated above for Boston Proper. Development is only one factor in the traffic equation. Continued demographic shifts will absorb part, but not all of the traffic access burden of new development. The most important future challenge will be to improve public transportation and regain the passengers which have been lost while effectively managing existing highway and street capacity.

Projected 1990 Impacts of Future Developments

Projected traffic, transit, and parking impacts of developments which have been completed since 1983 (when most of the existing traffic counts were done) or are now under construction are presented in Table 4.4. These impacts were derived from the 500 Boylston and Hynes EIR's, and assume that no significant changes in how people travel will occur between now and 1990.

Traffic: New developments are projected to add 10-11,000 vehicle trips per day. 3,000 vehicle trips will be added in the PM peak hour (which is presently the time when roads have the most traffic). The 500 Boylston Street development (with 1.3 million square feet of office and retail space) accounts for 15 percent of the all-day traffic increase, and 20 percent of the PM peak hour increase. The Hynes expansion accounts for 4-5 percent of the all day increase and 7-9 percent of the PM peak hour increase (depending on the type of event).

TABLE 4.4

Projected Impacts of Developments 1984-1990

	500 Boylston	Hynes average high[1]	Other2	Total	
Vehicle Trips					
Daily[3]	1,684	960/1,240	7,656	10,300-10,580	daily vehicle trips
PM Peak Hour	624	500/646	1,930	3,054-3,200	PM peak vehicle trips
Public Transit Trips					
Daily[3]	3,510	578/750	10,423	14,511-14,683	daily transit trips
PM Peak Hour	1,540	300/390	3,030	4,870-4,960	PM peak transit trips
Parking Demand Increase	990	550/1,750	3,477-3,717	5,017-6,457	spaces
Parking Supply Increase	675	550	2,558	3,780	spaces
Deficit (unmet demand)	275[4]	0-1,200	919-1,159	1,194-2,634	spaces

1. Average figure derived from 500 Boylston EIS and represents 77% of design event activity (traffic is estimated to be at or below design event level on 95% of event days); high figure is design event condition as analyzed in Hynes EIR.

2. Includes part of Copley Place, One Exeter Place, Four Seasons, 399 Boylston, Heritage-on-the-Garden, Prince chool, Hancock Renovation, and the State Transportation Building. Does not include Tent City, 739 Boylston, or 855 Boylston.

3. Round trips.

4. Assumes availability of 40 spaces in the National garage.

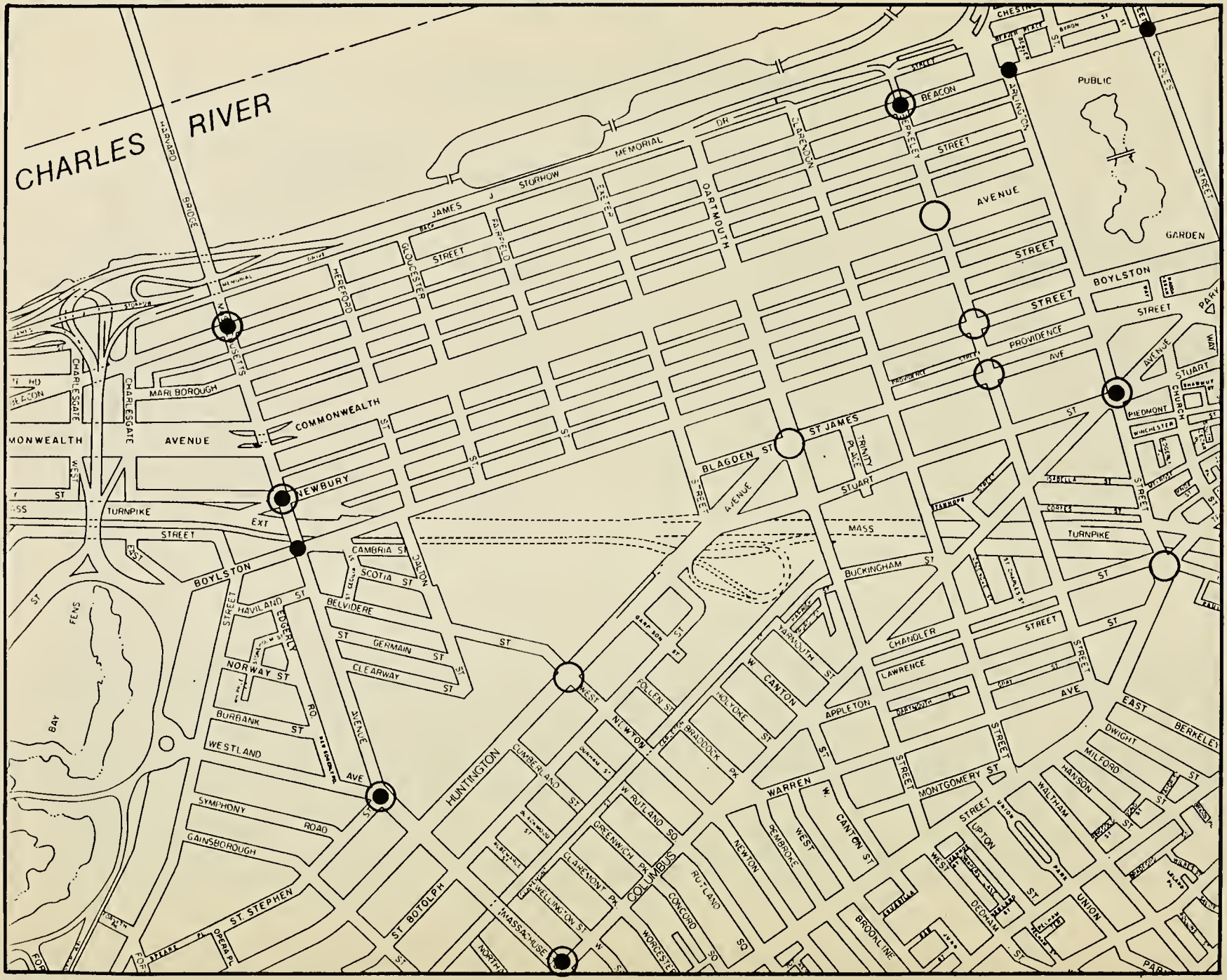
As shown in Figure 4.3, cumulative impacts of all new development are projected to increase the number of problem intersections[1] from 9 today to 14 in 1990. Detailed analysis of the incremental impacts of both the 500 Boylston and Hynes developments are provided in Appendix B. These show that each of these developments alone would be responsible for increasing

the number of problem intersections by three. The 500 Boylston project is projected to add between 10 and 230 cars to Back Bay street segments. Portions of St. James, Clarendon, and Berkeley Streets would be most affected by the project, experiencing 10-26 percent traffic increases. Impacts on other streets would be less than 10 percent. The Hynes project is projected to add up to 185 cars in the afternoon peak to individual street segments. Locations most heavily affected by Hynes (with increases of 100 or more cars) are Boylston Street from Exeter to Dartmouth, Massachusetts Avenue from St. Botolph to Columbus, and Berkeley Street from Commonwealth Avenue to Beacon St. All traffic increases on individual street segments for Hynes are projected to be 11 percent or less.

Public Transportation: New developments in the Study Area are projected to add about 14,500 new daily transit trips, 4,900 of which would be made in the PM peak hour. While there is not presently enough rapid transit capacity to handle these increases in trips, the Hynes and 500 Boylston EIR's assume that future public transportation capacity will be more than adequate due to the new Orange Line service to be instituted. However, this will depend on (1) the extent to which Green Line capacity

[1]Defined as those operating at level-of-service D (moderate congestion) and E (severe congestion).

Figure 4.3 Existing and Projected Future Problem Intersections



is freed up by Arborway passengers shifting to the Orange line, (2) whether the MBTA can improve service frequencies on both the Green and Orange Lines, and (3) the level of future increases in Green and Orange riders through the Area due to growth in downtown Boston and responses to service improvements which may be made. Existing estimates of the future ratio of passengers to capacity on the Green and Orange Lines vary considerably:

- Green Line (westbound) 30-118 percent
- Orange Line (northbound) 35-161 percent
- Orange Line (southbound) 69-115 percent

Thus, it is clear that adequate future public transit service should not be taken for granted.

Parking: Both the Hynes Auditorium and 500 Boylston Projects are projected to generate more demand for parking than they will supply. Hynes plans to meet its demand for parking on roughly 75 percent of its event days through construction of a 550 space remote parking lot at the Beacon Freight Yards, served by a shuttle. Parking demand on the remaining 25 percent of days will exceed 550 spaces. For these days, the excess will have to be met in other parking facilities.

The 500 Boylston project includes plans to expand the former St. James garage from 625 to 1,000 spaces, and to increase the capacity of the National Garage (located at Dartmouth and Buckingham Streets, adjacent to the new Back Bay Station) by 300 spaces, either through a physical expansion, or through conversion to tandem parking operation. Even with these actions, the project will still generate demand for 275 more spaces than it will supply.

Collectively, future developments are projected to create the demand for between 1,200 and 2,600 more parking spaces than these developments will provide. The existing parking inventory shows a total of about 2,000 spaces presently empty at midday--however many of these spaces are either reserved for private uses, or are in the Prudential garage and may be needed to meet Prudential's future needs. This potential parking shortage can best be addressed through management of parking to ensure that adequate, acceptably priced space is reserved for those who need it most--including delivery vehicles, visitors and shoppers.

5.0 IMPROVEMENT STRATEGIES IDENTIFIED IN PREVIOUS STUDIES

Many strategies have been identified to improve traffic and parking conditions in the Study Area. These can be grouped according to six goals which have been articulated by residents, the business community, and the City:

- improve vehicular access to/from Back Bay via non-residential streets;
- improve traffic flow conditions;
- reduce peak period (commuter) traffic;
- improve internal pedestrian and bus circulation;
- improve parking availability for shoppers, visitors, and delivery vehicles; and
- manage future growth in traffic.

Tables on the following pages list the various actions which have been proposed in past studies (primarily the recent EIR's, the HMM Back Bay Transportation/Traffic Study, the review of the 500 Boylston EIR by Steve Kaiser, and the Back Bay Transportation Management Improvement Work Plan prepared by the Boston Transportation Department in cooperation with the Neighborhood Association of the Back Bay and the Boston Redevelopment Authority) to address these goals. For each action, the tables indicate (1) what public agency/group would be the logical lead agency for ensuring implementation, (2) the status of the action (e.g., proposed, planned, or implemented), and (3) which reports identified, analyzed, or recommended the action.

I. IMPROVE VEHICULAR ACCESS TO/FROM BACK BAY VIA NON-RESIDENTIAL STREETS

Action	Lead Agency for Coordination	Status	Reports Identifying Actions
A. Signing for Alternate Routes: - Storrow via Charlesgate - Storrow via Embankment Rd/ Arlington - Southeast Expressway via Columbus/Mass Ave. -Remove truck route markings from residential streets -Install truck and bus prohibitions on each street between Commonwealth Ave. and Beacon St. from Arlington St. to Hereford St. -Signs in commercial areas to encourage use of Mass Pike rather than Storrow Drive.	Boston Traffic & Parking	Proposed	HMM Back Bay Study, 500 Boylston and Hynes EIR's, Kaiser review City Work Plan
B. Circulation Changes	Boston Traffic & Parking		
- Reverse Charles St. north of Beacon		Proposed - BRA Opposed	500 Boylston and Hynes EIR's
- Two-way Boylston St.		Proposed	HMM Back Bay Study, City Work Plan
- Arlington/Charles reversals proposal (make Arlington northbound and Charles southbound north of Tremont St.)		Proposed	HMM Back Bay Study
-Reverse Clarendon between Beacon St. and Commonwealth Ave or Boylston St.		Proposed	City Work Plan
-Reverse Berkeley St. between Boylston and Newbury Sts. between Beacon St. and Commonwealth Ave. and/or south of the Mass Pike		Proposed	City Work Plan
-Reverse Marlborough St. between Clarendon and Dartmouth Sts.		Proposed	City Work Plan
-Alternatives to approaches to Arlington St./Columbus Ave. intersection		Proposed	City Work Plan
C. Construction of New Access Points	Boston Traffic & Parking, Turnpike Authority, MDC		
- Mass Pike eastbound ramp (Clarendon/Columbus area)		Proposed	HMM Back Bay Study
- Storrow eastbound access at Dartmouth or Mass Ave.		Proposed	HMM Back Bay Study

I. IMPROVE VEHICULAR ACCESS TO/FROM BACK BAY VIA NON-RESIDENTIAL STREETS (continued)

Action	Lead Agency for Coordination	Status	Reports Identifying Actions
AD. Improvements to Access Roadways	Boston Traffic & Parking		
- Herald St. (Tremont to Albany)		Proposed	HMM Back Bay Study, City Work Plan
- Boylston/Essex Streets		Proposed	HMM Back Bay Study
- Embankment Road		Proposed	HMM Back Bay Study
- Boylston St at Mass Ave. and Charlesgate West		Proposed	City Work Plan
E. Restrict Access to Storrow Drive on Residential Streets	Boston Traffic & Parking, MDC		
- Close Storrow eastbound and/or westbound ramps at Berkeley		Proposed	HMM Back Bay Study, City Work Plan
- Prohibit left turns from Boylston and Stuart to Berkeley		Proposed	HMM Back Bay Study
- Close Back St./Clarendon access (peak hours only)		Proposed	Kaiser Review
- Discontinuous flow on Berkeley and Clarendon		Proposed	HMM Back Bay Study, Kaiser Review, City Work Plan
F. Visitor Information	Convention Center Authority		
- Hynes visitor information on recommended routes to Back Bay		EIK mitigation measure	Hynes EIR

II. IMPROVE TRAFFIC FLOW

Action	Lead Agency for Coordination	Status	Reports Identifying Actions
A. Intersection Improvements	Boston Traffic & Parking	Proposed	HMM Back Bay Study, 500 Boylston and Hynes EIR's, Kaiser Review, City Work Plan
- Berkeley/Beacon (curb use regulation, striping, signing, right turn lane)			
- Berkeley/Boylston (curb use regulation, right turn lane)			
- Arlington/Stuart/Columbus (curb use regulation)			
- Huntington/Belvidere (signal phasing)			
- Mass. Ave/Huntington (left turn lane)			
- Arlington/Beacon (signal timing, signing)			
- Boylston/Tremont (curb use regulation)			
- Beacon St. from Beaver St. to Brimmer St. (extend right turn lane)			
B. Systemwide Traffic Signal Improvement	Boston Traffic and Parking	Planned	HMM Back Bay Study, 500 Boylston and Hynes EIR's, City Work Plan
- Upgrade to computerized, real-time detection system			
- Optimize timing to reduce delay with simulation model		Proposed	
C. Parking Enforcement and Regulation	Boston Traffic and Parking		HMM Back Bay Study, 500 Boylston and Hynes EIR's, City Work Plan
- Reduce double parking by providing adequate loading and short-term (15-30 minute) parking through regulation and increased enforcement (particularly on Newbury St., Boylston St., Berkeley St.)		Proposed	
- Increase enforcement of resident permit parking to reduce cruising		Proposed	
- Increase enforcement of parking regulations on Berkeley St. from Newbury St. to Beacon St.; Arlington St. from Boylston St. to Stuart St.; and Clarendon St. from Newbury to Boylston Streets			
- Investigate additional locations (e.g., Stuart St. at Arlington St.) for peak hour parking restrictions and increase enforcement of existing restrictions at problem intersections		Proposed	

II. IMPROVE TRAFFIC FLOW
(continued)

Action	Lead Agency for Coordination	Status	Reports Identifying Actions
D. Commercial Vehicle Management - Encourage time shifts in delivery schedules - Install night-drop facilities - Restrict peak period commercial vehicle entry through a permit system - Impose peak period vehicle size restrictions - Encourage fleet dispatching efficiencies - Review location of loading zones - Relocate cab stand on Stuart St. near Arlington St.	Business Community, Boston Traffic & Parking	Proposed	HMM Back Bay Study, 500 Boylston and Hynes EIR's, City Work Plan
E. Traffic Control Officers		Proposed	Kaiser Review, Chamber of Commerce Transportation Subcommittee Recommendations, City Work Plan
F. Restrict Through Traffic - Storrow ramp closings or restrictions at Berkeley and Dartmouth (see I.E.)	Boston Traffic & Parking	Proposed	Norm Abend memo to Prudential, HMM Back Bay Study

III. REDUCE PEAK PERIOD (COMMUTER) TRAFFIC

Action	Lead Agency for Coordination	Status	Reports Identifying Actions
A. Public Transit Improvements	MBTA and Private Bus Operators		HMM Back Bay Study, 500 Boylston and Hynes EIR's, Kaiser Review
- Green Line operational improvements (more frequent and reliable service, track work, extended platform lengths, more express trains, monitoring of train separations, improved passenger orientation system, designation of platform section for passenger drop-off only)		Proposed	
- Orange Line service to Back Bay		Scheduled for early 1987	
- More MBTA express and private bus service		Proposed	
- MBTA employee incentive pay for ridership increases		Proposed	
- Evaluation of new subway corridors		Proposed	
B. Employer and Building Management Programs to Encourage Transit, Carpooling, and Bicycling	Employers and Building Managers		HMM Back Bay Study, 500 Boylston EIR, Kaiser Review, City Work Plan
- On-site sale of MBTA passes and private bus tickets and provision of transit and ridesharing information		500 Boylston mitigation measure	
- Carpool and vanpool matching and assistance service o through Caravan sponsorship o in-house o through coordinated program with neighboring employees/buildings		500 Boylston mitigation measure, proposed for others	
- On-site Commuter Transportation Coordinator		500 Boylston mitigation measure	
- Subsidy of employee transit passes		500 Boylston mitigation measure, proposed for others	
- Preferential parking for carpools and vanpools (discounts and priority assignment)		500 Boylston mitigation measure, proposed for others	
- Secure bicycle storage facility		500 Boylston mitigation measure	
- Constrained employee parking supply		500 Boylston mitigation measure	
- Rate structures which discourage all-day parking		500 Boylston mitigation measure, proposed for others	
- Back up services for car/vanpoolers working late		proposed	
C. Flexible and Staggered Work Hours	Employers	mitigation measure for 500 Boylston proposed for others	500 Boylston EIR, Kaiser Review

IV. IMPROVE PEDESTRIAN AND BUS CIRCULATION WITHIN BACK BAY

Action	Lead Agency for Coordination	Status	Reports Identifying Actions
A. Intersection Operational Changes to Reduce Pedestrian/Vehicle Conflicts - Allocate more time for pedestrians through automatic (in addition to existing push-button) pedestrian phases with red/yellow signal during peak periods (Berkeley/Boylston, Berkeley/Beacon, Arlington/Beacon) - Add more right-turn-on-red prohibitions	Boston Traffic & Parking	Proposed	Kaiser Review, City Work Plan
B. Improvements to Pedestrian Environment - Street and sidewalk cleaning - Sidewalk sheds	City	Proposed	Kaiser Review
C. New Bus Circulation Services - Newbury St. circulator	Private operator/business community	Proposed	Kaiser Review

V. IMPROVE PARKING AVAILABILITY FOR SHOPPERS, VISITORS, AND DELIVERY VEHICLES

Action	Lead Agency for Coordination	Status	Reports Identifying Actions
A. Improved Parking Enforcement	Boston Traffic & Parking	Proposed	HMM Back Bay Study, Kaiser Review
- Meters			
- Loading zones			
- Meter feeding penalties			
B. Increase Short-Term Loading Space			HMM Back Bay Study, Kaiser Review
- Identify additional locations		Proposed	
- Relocation/consolidation of existing spaces		Proposed	
C. Off Street Parking Strategies	Parking operators/business community	Implemented in Prudential garage; committed for 500 Boylston/ St. James garage	HMM Back Bay Study, Kaiser Review
- Reserved spaces for short-term parkers			
- Rate structures to encourage short-term and discourage long-term parkers		Proposed	
- Merchant validation/parking coupon programs		Initiated by Prudential	

VI. MANAGE FUTURE GROWTH IN TRAFFIC

Action	Lead Agency for Coordination	Status	Reports Identifying Actions
A. Transportation Impact Mitigation Requirements for New Development			HMM Back Bay, Kaiser Review City Work Plan
- Require future development proponents to identify steps to limit Berkeley/Clarendon traffic (to a volume/capacity ratio of .8). - Discourage granting of Air Pollution Control Commission permits unless traffic mitigation measures are sufficient.	Developers	Proposed	
- Require "access plans" from all new developments over 100,000 sq. ft., supported by 50¢ per sq. ft. fee	Developer	Adopted city policy; zoning amendment process initiated	City Transportation Framework
B. Development Size Controls - Height limits - FAR limits	City of Boston/BRA	Proposed	Boylston Zoning Study
C. Satellite Parking Facilities: to reduce traffic volume in Back Bay	City of Boston	Proposed	City Work Plan

APPENDIX A

TRAFFIC DATA: EXISTING CONDITIONS AND TRENDS

TABLE A-1

Intersection Traffic Counts - 500 Boylston EIR

	Intersection	Peak Period	Date (Day)
1.	Clarendon/Beacon	AM	5/24/83 (T)
2.	Berkeley/Beacon	AM	6/21/84 (Th)
3.	Beacon/Arlington	AM	5/24/83 (T)
4.	Charles/Beacon	AM	5/19/83 (Th)
5.	Commonwealth/Dartmouth	AM	5/19/83 (Th)
6.	Commonwealth/Clarendon	AM	6/21/84 (Th)
7.	Commnwealth/Berkeley	AM	6/20/84 (W)
8.	Arlington/Commonwealth	AM	6/21/84 (Th)
9.	Dartmouth/Boylston	AM	6/22/84 (F)
10.	Boylston/Clarendon	AM	5/23/83 (M)
11.	Berkeley/Boylston	AM	5/23/83 (M)
12.	Boylston/Arlington	AM	5/24/83 (T)
13.	Charles/Boylston	AM	6/26/84 (?)
14.	Dartmouth/St. James	AM	6/27/84 (W)
15.	St. James/Clarendon	AM	?
16.	St. James/Berkeley	AM	5/25/83 (W)
17.	Dartmouth/Stuart	AM	6/27/84 (W)
18.	Arlington/Columbus	AM	6/26/84 (T)
19.	Columbus/Dartmouth	AM	6/22/84 (F)
20.	Clarendon/Columbus	AM	6/30/83 (Th)
21.	Berkeley/Columbus	AM	4/14/81 (T)
22.	Tremont/Berkeley	AM	?
23.	Arlington/Tremont	AM	6/26/84 (T)
1.	Clarendon/Beacon	PM	6/04/83 (M)
2.	Berkeley/Beacon	PM	6/21/84 (Th)
3.	Beacon/Arlington	PM	5/24/83 (T)
4.	Charles/Beacon	PM	5/31/83 (T)
5.	Commonwealth/Dartmouth	PM	5/25/84 (W)
6.	Commonwealth/Clarendon	PM	6/21/84 (Th)
7.	Commnwealth/Berkeley	PM	6/20/84 (W)
8.	Arlington/Commonwealth	PM	6/21/84 (Th)
9.	Dartmouth/Boylston	PM	4/25/84 (W)
10.	Boylston/Clarendon	PM	5/23/83 (M)
11.	Berkeley/Boylston	PM	5/23/83 (M)
12.	Boylston/Arlington	PM	5/24/84 (T)
13.	Charles/Boylston	PM	6/26/84 (?)
14.	Dartmouth/St. James	PM	4/27/84 (F)
15.	St. James/Clarendon	PM	5/26/83 (Th)
16.	St. James/Berkeley	PM	5/25/83 (W)
17.	Dartmouth/Stuart	PM	4/27/84 (F)
18.	Arlington/Columbus	PM	6/26/84 (T)
19.	Columbus/Dartmouth	PM	6/27/84 (W)
20.	Clarendon/Columbus	PM	?
21.	Berkeley/Columbus	PM	6/28/83 (T)
22.	Tremont/Berkeley	PM	6/28/83 (T)
23.	Arlington/Tremont	PM	6/26/84 (T)

TABLE A-2

Intersection Traffic Counts - Hynes EIR
(All PM Peak)

	Location	Date (Day)	Hynes Activity
1.	Massachusetts Ave./Beacon St.	4/27/84 (F)	No
2.	Massachusetts Ave./Commonwealth Ave.	4/19/84 (Th)	No
3.	Boylston St./Dalton St.	4/26/84 (Th)	No
4.	Boylston St./Gloucester St.	4/26/84 (Th)	No
5.	Boylston St./Fairfield St.	4/25/84 (W)	Yes
6.	Boylston St./Exeter St.	4/24/84 (W)	Yes
7.	Boylston St./Dartmouth St.	4/25/84 (W)	Yes
8.	Dartmouth St./St. James St.	4/27/84 (F)	No
9.	Dartmouth St./Stuart St.	4/27/84 (F)	No
10.	Huntington Ave./W. Newton St.	4/30/84 (M)	Yes
11.	Beacon St./Clarendon St.	6/4/84 (M)	Yes
12.	Beacon St./Berkeley St.	6/21/84 (Th)	No
13.	Berkeley St./Boylston St.	5/23/83 (M)	No
14.	Massachusetts Ave./St. Botolph St.	4/30/84 (M)	Yes
15.	Massachusetts Ave./Columbus Ave.	10/15/84 (M)	No
16.	Beacon St./Exeter St.	10/11/84 (Th)	Yes
17.	Massachusetts Ave./Newbury St.	10/11/84 (Th)	Yes

TABLE A-3

Turning Movement Count Comparison:
Changes in Intersection Approach Volumes, 1973-1984

	Comparison Dates	Approach Traffic Volumes	Percent Change	Annual Increase/Decrease
Beacon/Clarendon	9/75-6/84	1,513-1,369	-10%	-1%
Beacon/Arlington*	9/75-5/83	1,592-2,084	+31%	+3%
	5/83-5/85	2,084-3,473	+78%	-33%
Commonwealth/Mass Ave.	4/75-4/84	3,295-2,563	-22%	-3%
Commonwealth/Dartmouth	7/73-5/84	1,938-2,094	+8%	+1%
Boylston/Hereford	3/74-4/84	1,451-1,549	+7%	+1%
Boylston/Dartmouth	6/73-4/84	2,041-2,216	+9%	+1%
Boylston/Arlington	9/75-5/84	2,176-2,688	+24%	+2%
Boylston/Charles	6/84-7/85	2,922-2,414	-17%	-17%
St. James/Dartmouth	12/75-4/84	2,522-2,334	-7%	-1%
Stuart/Dartmouth	12/75-4/84	2,256-2,358	+5%	+0.5%
Huntington/Belvedere	3/73-4/84	2,457-2,437	-1%	0
Columbus/Berkeley	2/73-4/81	2,560-2,556	-21%	-3%
Columbus/Arlington	12/74-6/84	2,183-1,736	0	0
Columbus/Clarendon	3/77-6/83	1,484-2,150	+45%	+6%
Tremont/Berkeley	9/75-6/83	1,865-1,947	+4%	+0.5%

* increases due to reversal of Charles St.

TABLE A-4

Past Studies of Intersection Level-of-Service

	Intersection	Copley (1978)	Hynes (1984/1988)	500 Boylston (1984/1989)	HMM Back Bay (1985)
1.	Beacon/Mass. Ave.		C/D		D
2.	Beacon/Exeter		A/A		
3.	Beacon/Clarendon		A/A	A/A	A
4.	Beacon/Berkeley		D/E	C/E	D
5.	Beacon/Arlington			A/A	D*
6.	Beacon/Charles			B/B	D
7.	Commonwealth/Mass. Ave.		B/B		B
8.	Commonwealth/Dartmouth	D		A/A	A
9.	Commonwealth/Clarendon			A/B	A
10.	Commonwealth/Berkeley	D		B/D	C
11.	Commonwealth/Arlington			A/A	A
12.	Newbury/Mass. Ave.		D/D		D
13.	Boylston/Mass. Ave.		C/C		D
14.	Boylston/Hereford	C	B/C		
15.	Boylston/Gloucester		A/A		
16.	Boylston/Exeter	C	A/A		
17.	Boylston/Dartmouth	D	A/B	A/B	B
18.	Boylston/Clarendon	D		B/B	B
19.	Boylston/Berkeley	D	C/E	C/E	B
20.	Boylston/Arlington	E		B/B	C
21.	Boylston/Charles			A/C	A*
22.	St. James/Dartmouth	C	B/E	B/D	C
23.	St. James/Clarendon	C		A/C	B
24.	St. James/Berkeley	D		C/D	A
25.	St. James/Arlington	E			
26.	Stuart/Dartmouth	C	A/A	A/A	A
27.	Stuart/Clarendon	D			
28.	Stuart/Berkeley	E			
29.	Stuart/Arlington			E/E	E
30.	Westland/Mass. Ave.		D/E		
31.	Huntington/Mass. Ave.		B/C		B
32.	Huntington/W. Newton	C	C/E		C
33.	Huntington/Exeter	C			
34.	St. Botolph/Mass. Ave.		B/C		B
35.	Columbus/Mass. Ave.		E/E		
36.	Columbus/W. Newton	C	B/C		
37.	Columbus/Dartmouth	C	A/A	A/A	A
38.	Columbus/Clarendon		B/C	A/C	B
39.	Columbus/Berkeley		A/A	A/A	A

Intersection	Copley (1978)	Hynes (1984/1988)	500 Boylston (1984/1989)	HMM Back Bay (1985)
40. Tremont/Clarendon			C/C	
41. Tremont/Berkeley			C/C	
42. Tremont/Arlington			C/D	

*based on new counts

Notes

1. Hynes/500 Boylston comparison: Hynes and 500 Boylston used the same turning movement counts as the basis for the level of service analysis. However, Hynes figures were factored up in certain locations to represent an event day, which was the "base case" for the EIR. Therefore, the Hynes analysis shows a worse LOS than 500 Boylston for certain intersections.

2. Copley/later studies comparison: The Copley EIR shows a consistently lower level of service for the 1978 base year than any of the later studies. This is difficult to explain. Comparison of turning movement counts used for Copley and the later studies generally shows that traffic has increased, and therefore level of service should be lower in later studies, not higher. One possible explanation could be that later studies used the critical volume method for level of service calculations (Circular 212) whereas Copley used the original method as described in the 1965 Highway Capcity Manual.

3. HMM results: With two exceptions, HMM level of service calculations were based on turning movement counts from Hynes/500 Boylston EIR's. Most of these counts (made in 1983/84) were factored up by 5-10 percent to represent 1985 conditions. Due to this factoring process, the HMM study generally shows a lower level of service than the Hynes/500 Boylston studies. The 5-10 percent growth factor used is not justified by counts documented in the HMM report. The HMM 1985 turning movement network and associated level of service calculations needs further justification or should be supplemented with additional counts in order to be credible.

FIGURE A-1

Existing Daily Traffic

Source: 500 Boylston DEIR

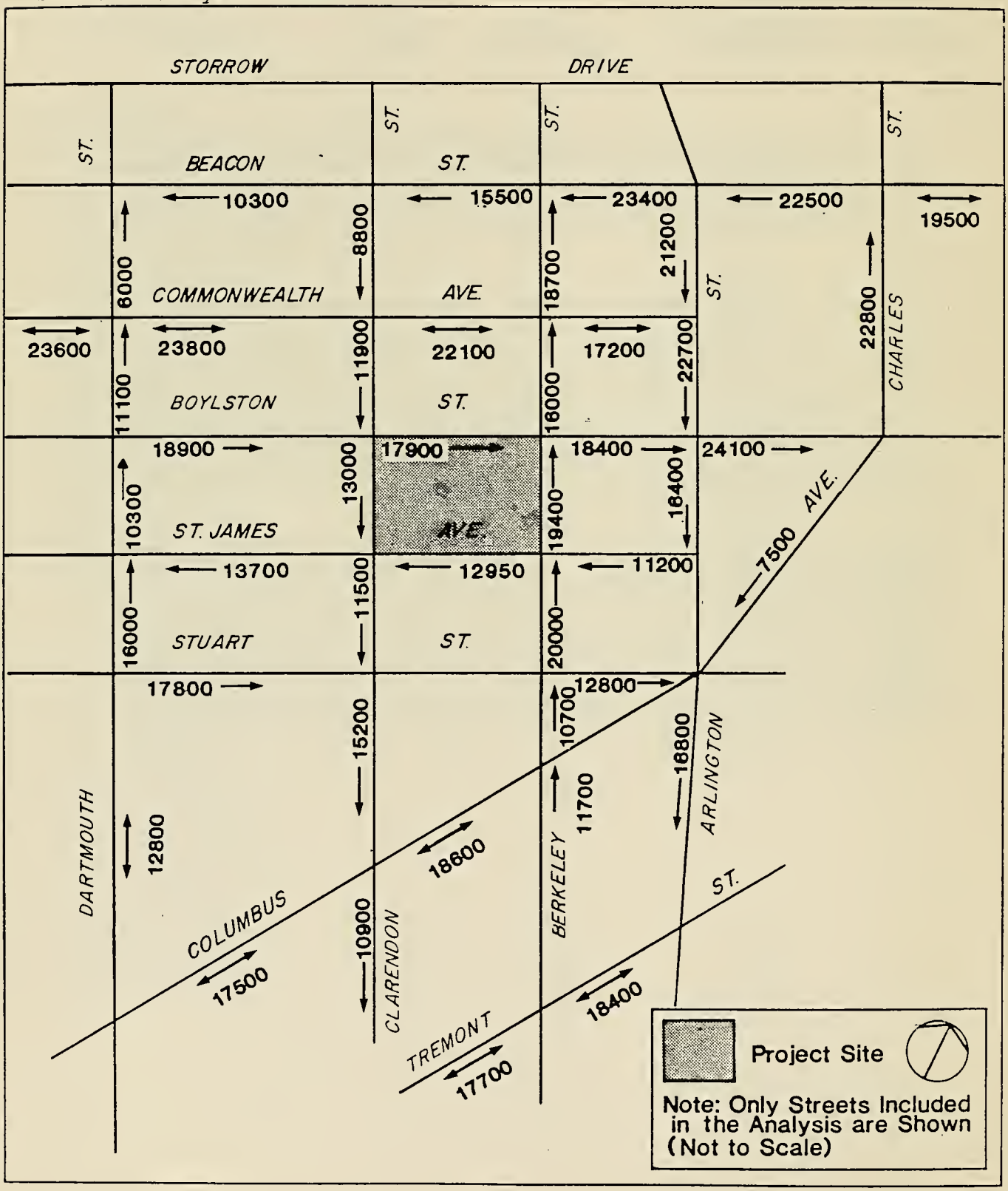


FIGURE A-2

Existing AM Peak Hour Volumes

Source: 500 Boylston DEIR

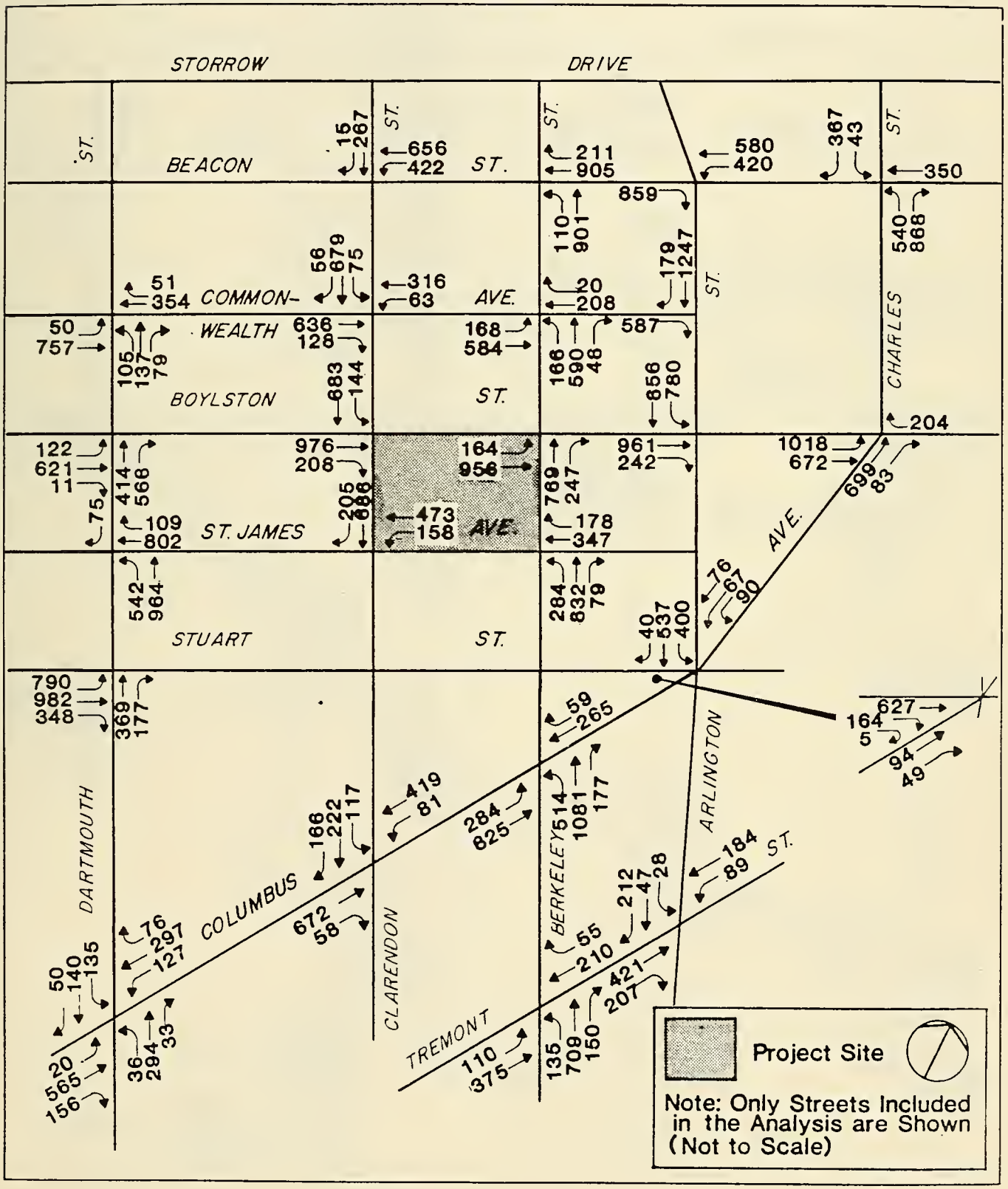


FIGURE A-3

Existing PM Peak Hour Volumes

Source: 500 Boylston DEIR

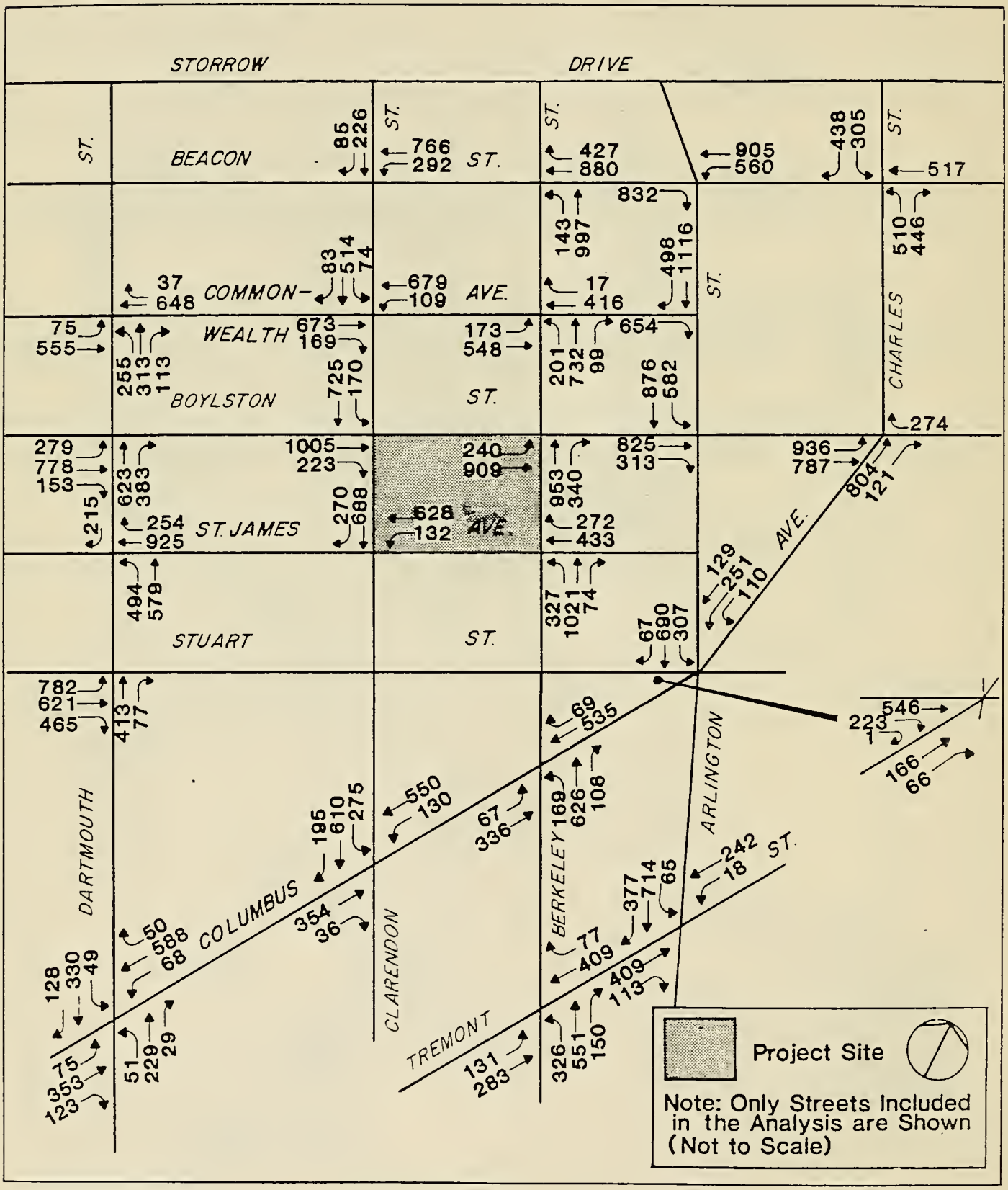
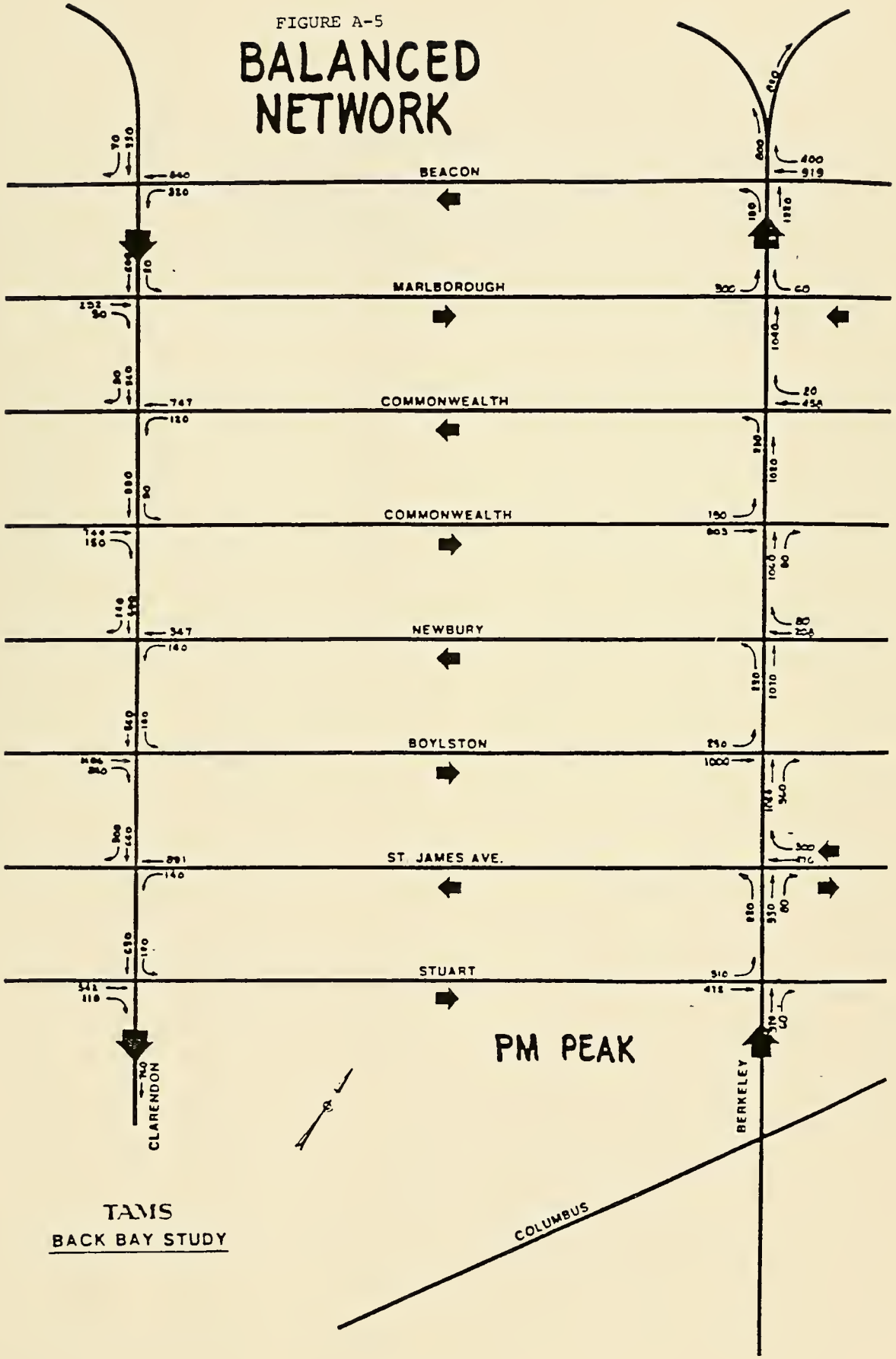


FIGURE A-4 1985 PM PEAK HOUR TURNING MOVEMENTS (4:30-5:30)

Source: HMM Back Bay Study

FIGURE A-5


BALANCED NETWORK
BEACON
MARLBOROUGH
COMMONWEALTH
COMMONWEALTH
NEWBURY
BOYLSTON
ST. JAMES AVE.
STUART
CLARENDON
BERKELEY
COLUMBUS
PM PEAK
TAMS
BACK BAY STUDY

APPENDIX B

FUTURE TRAFFIC IMPACT ANALYSES FROM

500 BOYLSTON AND HYNES EIR'S

TABLE B-1

PM Peak Hour Traffic Increases on Study Area Roadways

Source: 500 Boylston DEIR

Street	From	To	1989 Without Project	1989 With Project	Difference	Percent Difference
St. James	Berkeley	Clarendon	889	1,119	230	25.9
Clarendon	Stuart	Columbus	1,135	1,371	236	20.8
Clarendon	St. James	Stuart	837	970	133	15.9
Clarendon	Columbus	Appleton	831	950	119	14.3
Berkeley	St. James	Boylston	1,586	1,784	198	12.5
St. James	Dartmouth	Exeter	2,113	2,342	229	10.8
Berkeley	Newbury	Comm. Ave.	1,456	1,593	137	9.4
St. James	Clarendon	Dartmouth	1,045	1,142	97	9.3
Berkeley	Boylston	Newbury	1,508	1,645	137	9.1
Berkeley	Comm. Ave.	Marlborough	1,350	1,467	117	8.7
Berkeley	Marlborough	Beacon	1,553	1,671	118	7.6
Arlington	Columbus	Tremont	1,411	1,513	102	7.2
Boylston	Berkeley	Arlington	1,347	1,416	69	5.1
Columbus	Clarendon	Dartmouth	1,202	1,257	55	4.6
Arlington	St. James	Stuart	1,164	1,199	35	3.0
Arlington	Boylston	St. James	1,298	1,333	35	2.7
Boylston	Arlington	Charles	1,516	1,550	34	2.2
Comm. Ave.	Clarendon	Berkeley	1,606	1,626	20	1.2
Beacon	Clarendon	Dartmouth	886	896	10	1.1
Beacon	Berkeley	Clarendon	1,113	1,123	10	0.9

Note: Only study area roadway segments showing changes are included.

TABLE B-2

Intersection Level of Service Analysis Weekday PM Peak Hour

Source: 500 Boylston DEIR

	Existing		1989 No-Build		1989 Build	
	V/C	LOS	V/C	LOS	V/C	LOS
Beacon Street at Clarendon Street	0.36	A	0.37	A	0.38	A
Beacon Street at Berkeley Street	0.75	C	0.93	E	0.98	E
Beacon Street at Arlington Street	0.57	A	0.58	A	0.58	A
Beacon Street at Charles Street	0.64	B	0.64	B	0.64	B
Commonwealth Ave. at Dartmouth Street	0.48	A	0.51	A	0.57	A
Commonwealth Ave. at Clarendon Street	0.52	A	0.62	B	0.62	B
Commonwealth Ave. at Berkeley Street	0.67	B	0.80	C	0.88	D
Commonwealth Ave. at Arlington Street	0.49	A	0.49	A	0.49	A
Boylston Street at Dartmouth Street	0.57	A	0.63	B	0.63	B
Boylston Street at Clarendon Street	0.63	B	0.67	B	0.67	B
Boylston Street at Berkeley Street	0.76	C	0.90	D	0.98	E
Boylston Street at Arlington Street	0.66	B	0.60[1/]	B[1/]	0.63[1/]	B[1/]
Boylston Street at Charles Street	0.42	A	0.71[1/]	C[1/]	0.72[1/]	C[1/]
St. James at Dartmouth Street	0.65	B	0.80	C	0.86	D
St. James at Clarendon Street	0.60	A	0.66	B	0.75	C
St. James at Berkeley Street	0.73	C	0.82	D	0.84	D
Stuart Street at Dartmouth Street	0.40	A	0.51	A	0.52	A
Stuart Street at Arlington Street	0.92	E	1.04[1/]	E[1/]	1.09[1/]	E[1/]
Columbus Ave. at Dartmouth Street	0.51	A	0.55	A	0.57	A
Columbus Ave. at Clarendon Street	0.58	A	0.65	B	0.74	C
Columbus Ave. at Berkeley Street	0.47	A	0.47	A	0.51	A
Tremont Street at Berkeley Street	0.76	C	0.76	C	0.76	C
Tremont Street at Arlington Street	0.75	C	0.81	D	0.85	D

1/ Analysis assumes programmed roadway improvements.

FIGURE B-1

PM Peak Hour Level of Service

Source: 500 Boylston DEIR

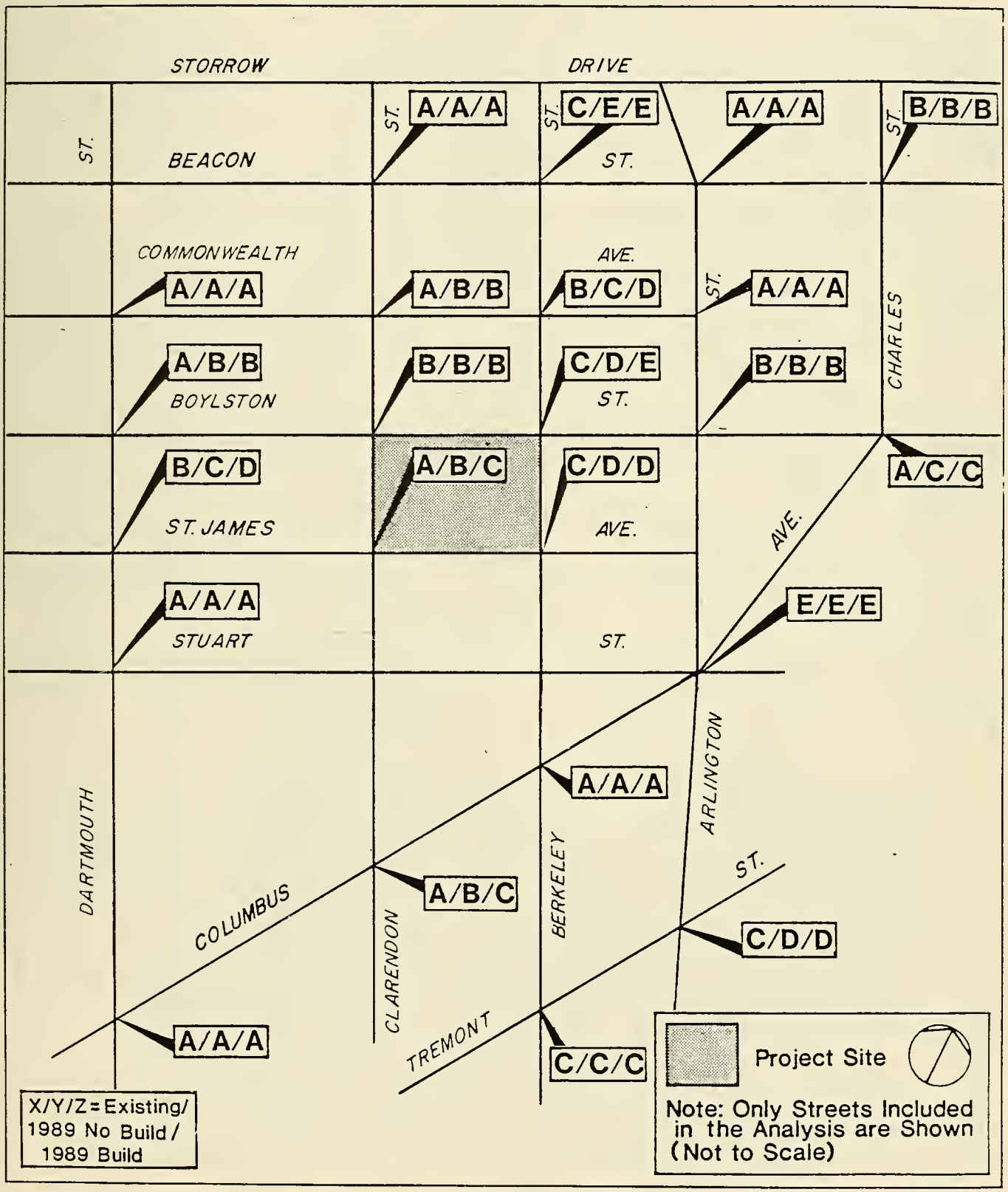


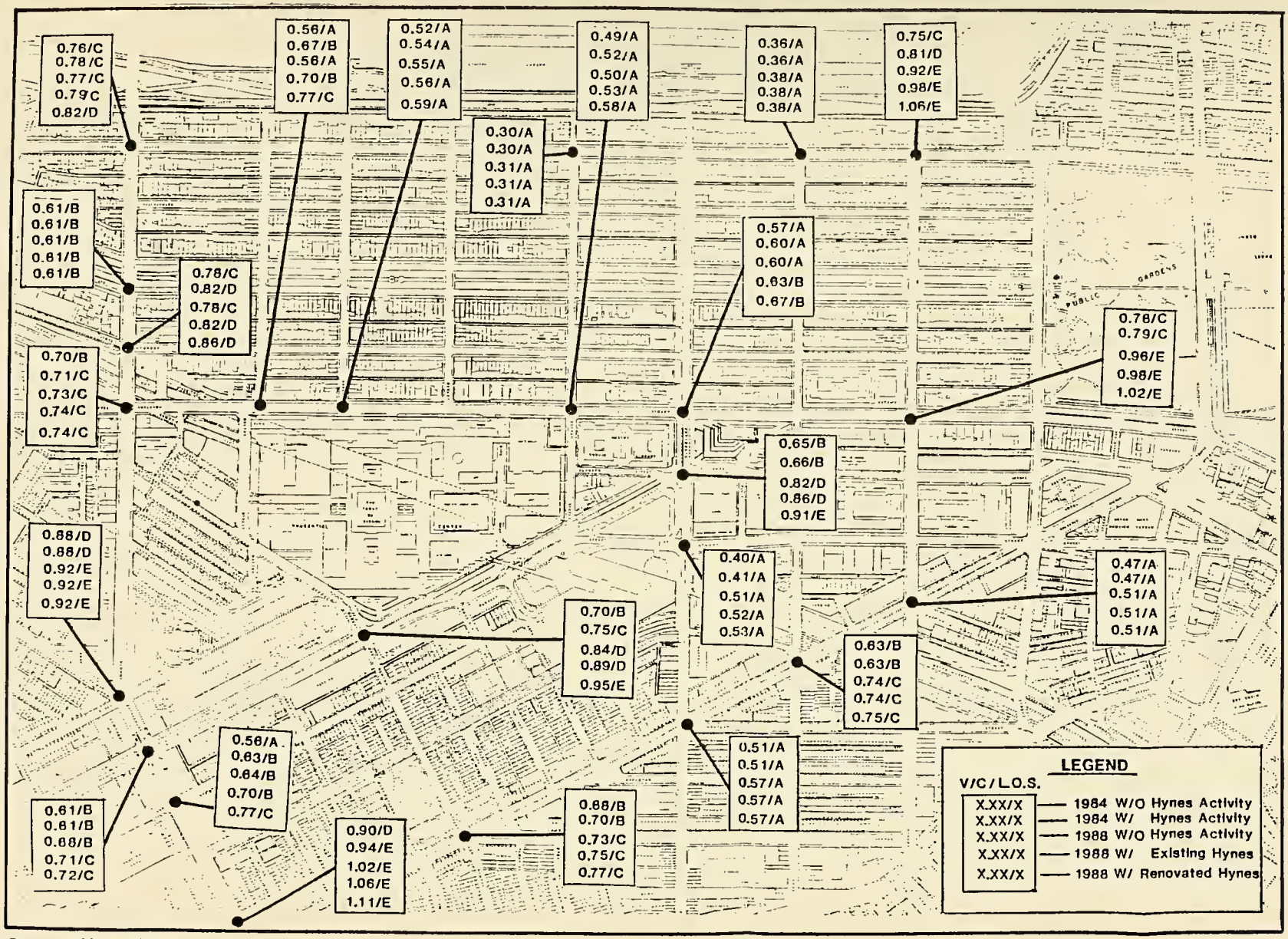
TABLE B-3. PM PEAK HOUR TRAFFIC INCREASES ON STUDY AREA ROADWAYS

	1984 Without Hynes Activity	1988 Without Hynes Activity	Change	1988 With Existing Hynes	Change	1988 With Renovated Hynes	Change	Percent Increase 1988 With Existing Hynes to 1988 With Renovated Hynes
Boylston Street (Eastbound)								
Mass. Ave. to Dalton St.	730	768	+38	768	0	768	0	0
Exeter St. to Dartmouth St.	1,286	1,297	+11	1,391	+94	1,500	+109	7.8%
Massachusetts Avenue (Northbound)								
Boylston St. to Newbury St.	765	796	+31	811	+15	829	+18	2.2%
Westland Ave. to Boylston St.	807	839	+32	839	0	839	0	0
Columbus Ave. to St. Botolph St.	1,016	1,036	+20	1,036	0	1,038	+2	0.2%
Massachusetts Avenue (Southbound)								
Newbury St. to Boylston St.	1,051	1,093	+42	1,099	+6	1,107	+8	0.7%
Boylston St. to Westland Ave.	985	1,024	+39	1,045	+21	1,070	+25	2.4%
St. Botolph St. to Columbus Ave.	1,003	1,166	+163	1,277	+111	1,407	+130	10.2%
Huntington Avenue (Eastbound)								
Mass. Ave. to West Newton St.	735	766	+31	766	0	766	0	0
Huntington Avenue (Westbound)								
West Newton St. to Mass. Ave.	875	1,068	+193	1,105	+37	1,148	+43	3.9%
Dartmouth Street (Northbound)								
Stuart St. to St. James Ave.	1,195	1,602	+407	1,651	+49	1,719	+68	4.1%
St. James Ave. to Boylston St.	1,006	1,068	+62	1,077	+9	1,086	+9	0.8%
Boylston St. to Newbury St.	902	980	+78	1,007	+27	1,039	+32	3.2%
Clarendon Street (Southbound)								
Beacon St. to Commonwealth Ave.	518	538	+20	538	0	538	0	0
Berkeley St. (Northbound)								
St. James Ave. to Boylston St.	1,293	1,761	+468	1,793	+32	1,831	+38	2.1%
Commonwealth Ave. to Beacon St.	1,140	1,521	+381	1,677	+156	1,862	+185	11.0%
Commonwealth Ave. (Eastbound)								
Mass. Ave. to Hereford St.	205	205	0	205	0	205	0	0
Clarendon St. to Berkeley St.	721	725	+4	760	+35	800	40	5.3%
Commonwealth Ave. (Westbound)								
Hereford St. to Mass. Ave.	264	346	+82	361	+15	379	+18	5.0%
Berkeley St. to Clarendon St.	617	669	+52	669	0	669	0	0
Columbus Avenue (Eastbound)								
Mass. Ave. to W. Newton St.	583	598	+15	598	0	598	0	0
Dartmouth St. to Clarendon St.	411	455	+44	455	0	455	0	0
Columbus Avenue (Westbound)								
W. Newton St. to Mass. Ave.	962	1,103	+141	1,108	+5	1,117	+9	0.8%
Clarendon St. to Dartmouth St.	726	785	+59	785	0	785	0	0

Source: Hynes FEIR

FIGURE B-2

Level of Service Analysis Summary - Weekday PM Peak Hour



Source: Hynes FEIS

APPENDIX C

Prudential Center Parking Inventory

Level 1		
North-Mezz		
Residential Reserved		
Gloucester	40	
Fairfield	58	
Boylston	28	
	126	126
Contractor Parking	6	6
	132	
South-Red		
Public	345	345
Total Level 1		477
Level 2		
North-Blue		
Public (for Saks)	250	
Public (general)	82	
	332	332
South-Orange		
VIP	30	
Reserve Area A	139	
Reserve Area B	6	
Security	15	
Handicapped	6	
	196	196
Public		
Saks	194	
General	19	
	213	213
Total Level 2		741

APPENDIX C (Continued)

Level 3

North-Green		
Residential Reserved		
Gloucester	127	
Boylston/Fairfield	228	
	355	
Public	486*	
	841	841
South-Yellow		
Sheraton Hotel		
Exhibition Hall	153	
Hotel Reserved	155	
	308	
Public	785	
	1,093	1,093
Total Level 3		1,934

Surface Lots

Residential Reserved	
Gloucester	40
Boylston	28
Fairfield	54
	122

* includes 259 spaces removed in March 1985 for Hynes construction

APPENDIX C (Continued)

Summary

Level 1	477
Level 2	741
Level 3	1,934
Surface	122
Total	3,274*

Available Now

Spaces removed for Hynes	(259)
Reduction in surface spaces (87 available now)	(35)
Total spaces available now	2,980*

* does not include 175-200 unstriped spaces in the garage

REFERENCES

Development Impacts

1. Copley Place Draft Environmental Impact Report Supplement/Draft Environmental Impact Statement, HMM Associates, Inc., February 15, 1980.

2. Copley Place Transportation Impacts Study, Final Report, prepared for Urban Investment Development Company, Parsons Brinckerhoff, Quade & Douglas Inc. and Normand A. Abend, February 8, 1980.

3. Copley Place Final EIR/EIS, HMM Associates, September 22, 1980.

4. "Hynes Auditorium: Final Environmental Impact Report", November 15, 1984, prepared by HMM Associates, Inc.

5. "Hynes Auditorium, Draft Environmental Impact Report", August 15, 1984, prepared by HMM Associates, Inc., Volume I and Volume II.

6. "Hynes Auditorium, Draft Environmental Impact Report", August 3, 1984, prepared by HMM Associates, Inc., and Vanasse/Hangen Associates, Inc.

7. "Expanding the John B. Hynes Veterans Auditorium: Design Review and Financial Feasibility Study," July 1983, prepared by Howard Needles Tammen and Bergendoff, Leventhol and Horwath, and Mechanical Electrical Energy/SCI.

8. "Parking and Traffic Analysis: Hynes Expansion", December 1982, prepared by Norman A. Abend.

9. "500 Boylston Street Project, Boston Redevelopment Draft Environmental Impact Report," October, 1984, prepared by Skidmore, Owings & Merrill, Vanasse/Hangen Associates, Haley & Aldrich, Tech Environmental, Wright Bros. Facility (MIT), and Historic Preservation Planning and Analysis.

10. "500 Boylston Street Project, Boston Redevelopment Final Environmental Impact Report," February, 1985, prepared by Skidmore, Owings & Merrill, Vanasse/Hangen Associates, Haley & Aldrich, Tech Environmental, Wright Bros. Facility (MIT), and Historic Preservation Planning and Analysis.

11. Steven Kaiser, "Transportation Review of the 500 Boylston Street Development", June 1985.

General

12. HMM Associates, "Back Bay Neighborhood Transportation and Traffic Engineering Study: Final Report" prepared for Boston Traffic and Parking Department, August 1985.

13. Cambridge Systematics, "Parking in Central Boston: Meeting the Access Needs of a Growing Downtown" prepared for Boston Traffic and Parking Department, December 1983.

14. Potterton, Philip, "Parking in Downtown Boston: Prospects, Problems and Recommendations for Change" memorandum prepared in fulfillment of the Spring Exercise Requirement, Master of Public Policy Program 1984, Kennedy School of Government, Harvard University, May 1984.

15. First Market Research, "A Profile of Visitors at Copley Place, Newbury Street and the Prudential Center", prepared for Clarke Goward Fitts, January 1985.

16. First Market Research, "A Profile of Late August Visitors to Copley Place, Newbury St. and the Prudential Center", conducted for Clarke and Company, August 1985.

17. First Market Research, "A Profile of Christmas Season Visitors to Copley Place, Newbury Street, and the Prudential Center, prepared for Clark & Company, January 1986.

18. TAMS, "Back Bay Origin-Destination Study", conducted for the Boylston Zoning Study, December 1985.

19. TAMS, Downtown Boston Cordon Count 1982, prepared for Boston Traffic & Parking Department.

20. City of Boston Transportation Department, "Transportation: A Framework for Improved Access", February 1986.

21. Abend, Normand A., Edison Parking, and Barton Aschman Associates, "Traffic/Parking/Service Evaluation", December 13, 1984.

22. "Downtown Transportation: Issues & Recommendations-Final Report" Subcommittee on Traffic and Parking of the Boston Chamber of Commerce Legislative Affairs and Transportation Committee.

23. Boylston Street Zoning Study-Interim Report, March 22, 1985.

24. City of Boston Transportation Department, "Back Bay Transportation Management Improvement Work Plan", July 16, 1986.

25. "Change and Growth in Central Boston", Development Guidance Project, Greater Boston Chamber of Commerc, Boston Society of Architects, May 1984.

26. "Third Harbor Tunnel, Interstate 90/Central Artery, Interstate 93, Final EIS and Final Section 4(f) Evaluation", Federal Highway Administration and Massachusetts Department of Public Works, August 1985, Volume 1, 2 and Appendices.